SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXX.—No. 20.
ESTABLISHED 1845

NEW YORK, MAY 19, 1894.

$3.00 A YEAR.
WEEKLY.

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THE LAWRENCE UNDERGROUND CONDUIT ELECTRIC TROLLEY RAILROAD.

The cable traction system for street cars has received, certainly, very great development, and examples of its most modern form, with the latest improvements, are to be found in this city, where the Broadway and the Third Avenue lines are both operated by it. Its defects are many and important; the original cost of the plant is very great, and whether many or few cars are in operation the cable has to be kept going at a standard speed, so that considerable power may be uselessly expended during the night hours. Seventy-three per cent is wasted on the Philadelphia cable lines. Naturally, its operation is more economical as more cars are running. On curves a car cannot be stopped, and on at least one curve in this city there has been a great deal of difficulty in conducting the traffic, the cars being perpetually interrupted in their progress.

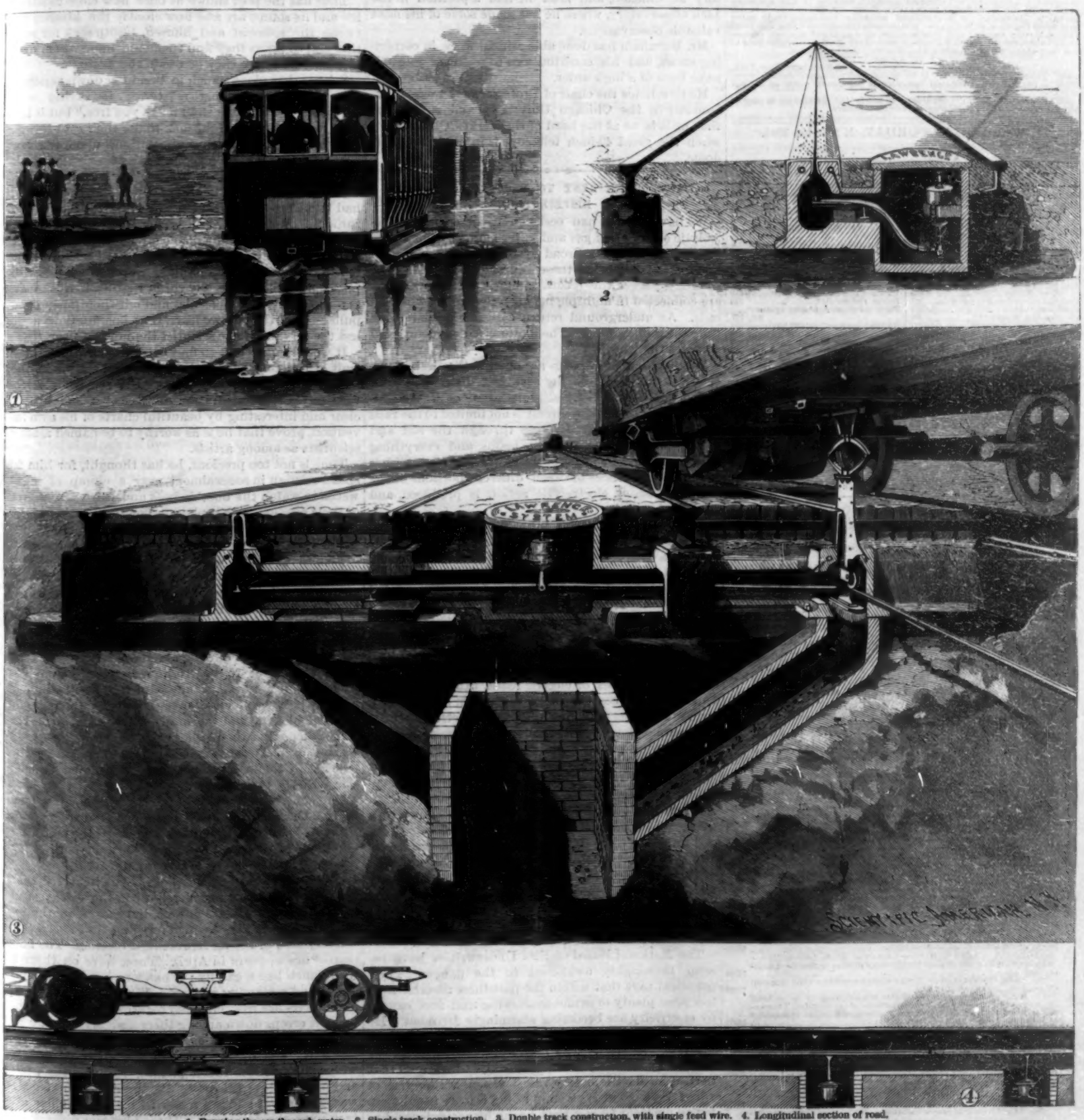
In our present issue we illustrate the Lawrence system of underground trolley, the invention of Mr. William Lawrence, of this city.

Accepting the fact that the trolley, so far, has proved itself the most available mechanism for car traction, Mr. Lawrence has invented an underground system in which the inherent difficulties, which have made all electric conduit systems heretofore useless, are so thoroughly overcome that, with the conduit filled with water and the track completely flooded, the car is driven as easily through the water as on the dry track. The leading feature of the Lawrence road is the use of circuit breakers, which, as the car passes, bring into circuit 32 foot sections of a girder or trolley rail. As each section is passed by, it goes out of circuit. A single feed wire is carried along the track and connects with each of the 32 foot sections of the trolley rail to the switches. As at present constructed, the regular rails are used for the return.

Several constructions of the road are shown in section in our cuts. In one of the engravings may be seen a cross section of the single and double track road, and at the bottom of the page we give a longitudinal section showing the trolley rail in place in the conduit. On page 311 we show a new form of rolled steel conduit, which will probably be adopted, as it occupies a space of but 4½ by 9 inches.

The general construction resembles the cable conduit but is much simpler. Through and along the conduit formed under the slot passes a small girder or trolley rail in 32 foot sections, fastened together by

(*Continued on page 311.*)



1. Running the car through water. 2. Single track construction. 3. Double track construction, with single feed wire. 4. Longitudinal section of road.

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Scientific American.

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MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, MAY 19, 1894.

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AN ASTRONOMER HONORED.

The Royal Astronomical Society has sent a gold medal to Mr. S. W. Burnham in recognition of his discovery and measurement of double stars. Upon the presentation of the medal, Captain W. De W. Abney, D.C.L., F.R.S., president of the society, delivered an address, in which he reviewed Mr. Burnham's astronomical work.

Like so many of his *confreres* in astronomical research, Mr. Burnham began as an amateur. He discovered his first 81 pairs of double stars with a 6 inch telescope in Chicago, between 1870 and 1872. He had then no micrometer, and in his first catalogue his distances are not exact measurements, but only estimates. Mr. Burnham has added catalogue after catalogue to his first list of double stars, so that he has published nineteen, containing 1,274 pairs, and another list is now in press.

A remarkable characteristic of Mr. Burnham is that his eye is so acute that he detects a deviation of an infinitesimal quantity from the circular in the disk of a star. Before he began his work, astronomers were not trying to add to the old catalogues of Herschel and the Struves, but his eye saw so much he could not help but make note of these double stars; indeed, he has catalogued a new class, viz., naked-eye stars which have faint companions. Of the whole number he has published, 197 are naked-eye stars not before known to be double.

Since his early discoveries, Mr. Burnham has had the use of the 15½ inch refractor at the Dearborn Observatory at Chicago, and later he had a position in the Lick Observatory, where he has made some of his most valuable observations.

Mr. Burnham has done able critical work in correcting errors, and his contributions to scientific journals have been of a high order.

He now holds the chair of Professor of Practical Astronomy in the Chicago University, and rumor says that he is to be at the head of the Yerkes Observatory when the great 40-inch telescope is in place under its dome.

DANGERS INCIDENT TO ELECTRIC CURRENT DISTRIBUTION.

We have already had occasion to describe the electrolytic corrosion of gas and water mains by the return current of trolley railroad systems. The universal method in vogue with these railroads is to utilize the rails as a part of the return circuit. The car motors are connected in multiple between the trolley wire and rails. An underground return cable connected to all the rails is often used. The motor circuit is completed through the wheels

When a number of paths are open to the electric current it does not choose the best, but distributes itself proportionately to the resistance among all. Accordingly, the return trolley circuit is not limited to the rails and return cable, but diverges through the soil and utilizes water mains and gas mains and everything that it can get at as part of its path. This establishes potential differences between different portions of the pipes and mains, electrolytic action is produced, and the metal rapidly succumbs.

Several papers on this subject have recently been presented before electrical societies, which show how serious a trouble electrolytic corrosion has become. Samples of corroded pipes were exhibited and various suggestions for overcoming the trouble were suggested or discussed. It has been found that in many cases a current would pass through a wire connecting a couple of pipes, perhaps in a house far removed from the trolley line, and a perceptible spark could be obtained on breaking the circuit. It is said that many residents on the lines of electric roads utilize these currents in their houses, something which, at the least, suggests playing with fire, where an electric potential difference of 500 volts is involved. In one case a gas and a water pipe were found running close together. A neighboring elevator jarred them so frequently that the gas pipe, by mechanical abrasion, perhaps re-enforced by electric action, was nearly worn through. The fact that electric action existed was shown by a spark which formed at every break of contact. In some way the pipes became charged with electricity and at different potentials. It was merely a question of time when the gas main would become completely worn through, the gas would escape, the spark would light it and a conflagration, "cause unknown," would have been the result. Such a disaster might occur in a building that had no electric service within it.

The National Board of Fire Underwriters have become thoroughly awakened to the danger. Their president says that within the past three months there has been plenty of evidence showing that fires caused by electricity are becoming alarmingly frequent. He calls electricity the "greatest present enemy" of the insurance interest. The result of inspections shows that many buildings are imperfectly wired, and that perfect insulation is very rare. When a safe size of wire for a current is given, nothing is more usual than for an amateur to say that he in his experience has got twice the current through the same sized wire. The professional engineer, however, has gone beyond this stage, and uses wires of ample dimensions. But the necessity for absolute insulation in view of recent troubles is very clear, and the possibility of a house without electric service suffering from imperfect street mains is a thing which must be taken into account in future street work. The electrical engineers and inventors have solved the greater problem. They know how to do their work and how to produce results in the direction of distribution of electric energy, but the distribution is at fault in being altogether too wide. The next step must be the retaining the current within the desired circuit. Much remains to be done in this direction.

"THE HARVEST OF A QUIET EYE."

The poets were the earliest observers and they have never abandoned the field. In proportion as they have studied Nature in her varying modes and phases; as they have watched men, the play of their emotions and the development of their motives into action, have they been the interpreters of Nature and of men and have sung songs which linger in the world long after their voices are still.

Tennyson wrote:

> Flower in the crannied wall,
> I pluck you out of the crannies:
> Hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

Thus has the poet shown at once how close together life and its source are and how close is the kinship between the scientist and himself. Both seek for verities, and so far as they find them and hand them over to their fellows are they of use in the world.

Science has done much in breaking down superstition, and in unraveling mysteries, in saying with Scripture, "The truth shall make you free," but it has done more; it has taught men to use their eyes so well as to be slow about basing conclusions upon too few data.

Professor Huxley, in writing of his friend Tyndall, says: "That which he knew, he knew thoroughly, had turned over on all sides, and probed through and through. Whatever subject he took up he never rested till he had attained a clear conception of all the conditions and processes involved or had satisfied himself that it was not attainable. And in dealing with physical problems, I really think that he, in a manner, saw the atoms and molecules and felt their pushes and pulls." And thus do we learn that imagination is no less the servant of the scientist than of the poet.

It would be difficult to find better illustration of the fruit of quiet-eye observation than that shown in the work of Mr. Hamilton Gibson. His remarkable lectures on "Cross-fertilization of Seeds," made doubly clear and interesting by beautiful charts of his own invention, prove that he is as worthy to be named among scientists as among artists.

Time is not too precious, he has thought, for him to spend enough in concealment near a clump of milkweeds to watch the bumble-bees and learn the secret of their relation to that plant. The fertilization of the trumpet creeper had never been satisfactorily explained until Mr. Gibson discovered that it is the work of humming birds. They thrust their long bills down into the nectaries at the base of the blossom, and come out with their backs covered with pollen, which they give to another flower when they seek the same sweets there.

We have all found flies entrapped in corollas and seen birds and bees darting about among the flowers, often too intent to be frightened away by our approach; but not even botanists of fair repute in our century have been close enough lookers to find out that the blossom and the insect have been made for each other—that the perpetuation of species is secured by that drop of sweetness hidden where it cannot be reached by the insect or bird without coming in contact with the pollen.

The old Arabian proverb, "A fig tree looking on a fig tree becometh fruitful," has now an explanation. Pliny and other early writers mentioned the fact that two kinds of fig trees must grow near together if they produce fruit, but they do not account for it.

Close observers in recent times have discovered that the proverb is based not merely upon the existence of staminate and pistillate flowers, but also upon the intervention of an insect which fertilizes them.

Every seed of the fig represents a blossom. The first crop of figs appears in April. These have on them a wasp much like a gall fly; it has four gauzy wings, jet armor and a piercing poniard. When the first pistillate flowers are ripe, crowded together on their receptacle, it creeps down among them and lays an egg in the ovary. A hundred eggs may be laid on one receptacle. The ovaries nourish the embryos of the wasps; they grow there, passing through the grub and pupa states; the males die there, but the female wasps come out and are ready to make a similar attack upon the June crop. These blossoms differ from the early ones in that they have pollen. The wasps,

going into these, cannot get out without becoming covered with pollen, and from them they go to another tree near by which bears true figs, and give to them the pollen; this fertilizes the ovaries, they grow and develop into luscious fruit. There are, therefore, three crops, as it were. The first two are called *capri* figs; the ancients knew them by this name; they sometimes hung branches of the *capri* figs upon the true trees, finding that unless they were brought together in some way, no fruit matured.

The secret of the insects' work has been a modern discovery. Mr. Gibson calls attention to this, one of the most curious examples of cross fertilization, along with those that he has himself made.

The soundness of judgment which the scientist must possess and the gift of expression which the poet has belong to the few, but their methods of observation we may all adopt. And as the resurrection miracle of the spring time is once more going on, there are inviting opportunities. A thrifty robin proved the truth of this a week ago. She was looking about in the grass before my window and had already in her bill what seemed a good load of twine, when she spied a rag which had probably been the tail of a kite. It was narrow, but fully half a yard long. Mrs. Robin evidently considered whether she should leave the twine for this larger prize, but decided to take both. She picked up the rag, dropped it, and took it up again, and again, until she had it so nicely balanced that she could take to her wings. The first flight took her only to a low bough of a tree near by; a little higher she stopped again; the third flight carried her out of sight among the topmost twigs. The precious rag could not have been more useful in the home the robin was building than were the lessons in perseverance and industry which she gave to her unseen observer.

Concrete and Cement Walling.

Cement concrete is now being extensively used for walling and arching purposes with eminently satisfactory results, having regard to its durability in water, earth, or air, and the high resistance it offers to compressive strain. Concrete made of one part by volume of Portland cement and three parts of clean sharp sand is capable of resisting a compressive strain of from 1 to 1½ tons per square inch, while it can with ease be moulded into blocks of any form or dimensions. There is, therefore, no reason why it should not be advantageously used in the lining of shafts, especially where the sand or ballast for the making of the concrete is conveniently procurable. The walling might be built of large blocks of concrete moulded to the radius of the shaft, or of concrete deposited *en masse* behind a properly constructed cylindrical tube, forming, as it were, a guide for the walling. An interesting account of the use of cement in shaft sinking on the Continent is given by Mr. Bennett H. Brough in a paper read before the Federated Institution of Mining Engineers, in which he describes the tubbing of shafts with cement blocks so made and laid as to be perfectly watertight. The blocks are moulded into segments provided on their upper and lower surfaces with grooves and tongues, in much the same manner as match boards, the groove being slightly deeper than the tongue, to enable the joint to be made good with cement. Each block has both its ends grooved out, so that when two blocks are joined together there is in the center of the joint a hollow tubular space, into which cement mortar is tightly rammed, forming, so to speak, a tongue, thus securing and rendering watertight the vertical joint in the same manner as the horizontal joint. In laying one tier of blocks upon another they are so disposed that the vertical joints of one tier are placed over the center of the blocks in the other tier, the intention being to break the joints. The blocks weigh from 1,543 pounds to 1,763 pounds each.

Mr. Brough recounts several instances of the successful application of this process on the Continent, notably the Serlo Colliery, belonging to the Prussian government, at Saarbrucken, where segments of 15·75 inches in thickness and 23·62 inches in height and length were employed, the diameter of the shaft being 9 feet 10 inches. Another instance is that of the salt mines of Leopoldshall, near Starsfurt, where a shaft 500 yards in depth and 17 feet 2½ inches in diameter was tubbed in this manner to exclude the enormous volumes of water met with in the saliferous strata.

In some cases a double ring of cement segments has been employed. According to the particulars given, the cost of the cement lining is considerably cheaper than that of brick lining. The cost of cement tubbing with a single ring of segments is 25*s.* 6*d.* per cubic yard, the estimate including the cost of material and labor for making the blocks, as well as the setting and filling with concrete.

It is estimated that a ring of 13 feet 1½ inches in internal diameter and 13·78 inches in thickness, containing 183·65 cubic feet, costs 7*l.* 7*s.* a yard. To enable a fair comparison of the respective costs of brickwork and cement to be made, it is necessary that the prices of bricks should be stated. Taking the average price of bricks in our own colliery districts in England and Wales at 2*l.* 8*s.* per 1,000, the brickwork, inclusive of all labor and materials, would not exceed 1*l.* 5*s.* per cubic yard, so that there would really be very little difference between the cost of brickwork and cement.

Probably, in Germany, where the above estimate applies to, there is a greater disparity between the prices of materials operating in favor of the adoption of cement. The process, it is stated, has so far proved very satisfactory, and whatever its advantages and disadvantages may be, it is certain that cement concrete is destined to be an important factor in shaft work, as well as in engineering construction generally. —*Engineering.*

Unexplored Arabia.

Mr. and Mrs. Theodore Bent have just returned to England from their scientific expedition in the hitherto almost unknown Hadramaut district of Arabia. In an interview with a representative of Reuter's Agency the explorer gave an interesting account of his experiences. Mr. Bent said:

"Leaving Aden in November last, we proceeded by steamer to Makellah, the nearest point to the Hadramaut Valley, and after journeying for about three weeks, in the course of which we covered some 150 miles, we reached the interior district, our intended goal. The country from the coast to Hadramaut consists of a mountain range and an arid elevated plateau, calling for no special remark. It is practically uninhabited. Contrary to the general belief, the Hadramaut is not a district extending to the coast, but is merely a portion of a big valley in the interior. It is a long valley, in places as much as seven miles wide, but probably its whole extent is about 100 miles. It contains several towns of considerable size, the chief characteristics of which are the magnificent palaces of rulers and the palm groves which produce the splendid dates grown in Arabia. The Hadramaut is inhabited by Arabs and Bedouins, who are divided up into various sections, and are constantly at war with one another. My expedition spent a month in the palace of the Sultan of Shibam, one of the principal towns of the valley. From here we made excursions, often under the Sultan's personal escort, in various directions. The Sultan, who is a member of one of the most powerful and richest families of Arabia, had lived in India for a number of years. I found him to be a very enlightened and well informed man, and one who took a great interest in our work and in the exploration of the ruins in his neighborhood. With regard to the archæological results of the expedition, we came across a number of inscriptions and sites of Sabæan towns. Owing to the kindness of the Sultan, we were able to visit one of the sacred places of the Arabians, which had never before been seen by Europeans. The country has, in fact, only been visited by two Europeans within living memory. Both these travelers were Germans. One visited the country forty years ago, and was driven out by the natives. The other, who penetrated last year, met with great difficulties from the tribes."

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Eastern District of Pennsylvania.

L. DURAND, HUGUENIN & CO. *v.* GREEN, SCHULZE-BERGE & KOECHL.

Letters Patent No. 258,721, issued to Horace Koechlin February 14, 1882, for the manufacture of colors or dye-stuffs, construed, and held to claim and to cover a process only.

Judge Dallas, in his decision of this case, gives the following lucid explanation of the principles which must govern the court in construing patent claims:

It was directed by the act of 1836 (sec. 5) that the patent, although annexing the specification of what the applicant claimed as his invention, should "contain a short description or title of the invention or discovery, correctly indicating its nature and design," and should "grant the full and exclusive right to the said invention." It was with express reference to and upon construction of these terms of the act of 1836 that it was decided in Goodyear *v.* R R. Co. that the patentee's monopoly was not, in that case, limited by his claim, but extended to the invention which was described, and the nature and design whereof were correctly indicated in the specification. After the passage of the act of 1836 the profession recognized the convenience and utility of formally stating the claim for which it made provision at the end of the specification, and, from the practice which ensued, as well as for other manifest reasons, the courts were led, as in Goodyear *v.* R.R. Co., to give to such claims much, but not controlling, weight in determining the scope of patent rights.

I now turn to the act of 1870, under which the patent in suit was granted It is, as to the subject under consideration, markedly different from the act of 1836. It mentions the specification and the claim as two distinct things, and requires an inventor, not merely to specify and point out, but to "particularly point out and distinctly claim" his invention. The change in words is very slight; but the difference in meaning is obvious and important. By the one act he was instructed to specify what he alleged to be his invention; by the other he is told that the invention for which he desires a patent he must distinctly claim. The fact that, except as to the change just indicated, the words used in the two acts, when dealing with this matter, are substantially identical is quite convincing that the draughtsman of the act of 1870 actually as well as in presumption of law thus peculiarly varied the language of the act of 1836, not without reason, but with a definite purpose. Nor is the legislative design hard to discern. The practice of the profession and the opinions of the judges, to which I have adverted, had suggested that the embarrassments attendant upon the efforts of the courts to construe vague and indefinite patents might, without doing injustice to patentees, be much alleviated by denying protection for anything, though original, new, and useful, which was not also distinctly claimed.

In brief, it was prescribed that the claim must be taken as defining precisely what the invention covered by the patent is, and hence the true question is not what the patentee might have claimed, but what he has claimed, the latter, not the former, being made the measure of his right. The rules for determining what is claimed in any case are few and simple and are not peculiar to the patent law, except as respects the doctrine of liberality in construction in favor of pioneer inventors. The benefit of that doctrine is claimed by these complainants, and without pausing to examine their title to invoke it, for it cannot avail them, I concede, for the present purpose, its applicability to the achievement of Koechlin. As to the rest, it is sufficient to say that if the language of a claim has a plain and distinct meaning, that meaning must prevail. That which is to be ascertained is, of course, the intent of the claimant, not, however, that intent as elsewhere or in some other manner disclosed, but as expressed in the claim itself. If the meaning of the claim be uncertain—that is to say, if the claim be ambiguous—but still be reasonably capable of elucidation by reference to the specification, the latter may be resorted to for interpretation of the former, but never to change the plain meaning of its language nor to extend it beyond the limits imposed by its own terms, and, *a fortiori*, not so as to create a separate or additional claim.

The National Zoological Park.

The preservation of certain species of American animals, now nearly extinct, was the primary object for which Congress was asked to establish a national zoological park at Washington. The appropriations asked for were very moderate, but in all cases they were cut down. Thus: $36,850 was asked for to erect the necessary buildings; Congress reduced this estimate to $18,000. In this connection it may be noticed that, in Philadelphia, the amount expended for buildings and inclosures was $194,705. The result of this parsimony has been that expedients of a temporary character were adopted, which have proved far from economical. Notwithstanding the inadequacy of the appropriations, the results achieved are highly satisfactory and reflect great credit upon the Smithsonian Institution and its officers. The park, which occupies 40 acres, can be reached by Ontario Avenue. The total number of animals in the park is 448, of which 340 are indigenous to North America. Fifty-five of the animals were obtained by purchase. The animal house, a stone structure, is the principal building. The bear yards are in an abandoned quarry. As Congress has saddled a portion of the expenses both for construction and maintenance upon the District of Columbia, it is little wonder that the new park is largely frequented by residents of the District. Strangers are, however, beginning to visit the park in fair numbers.

Skins of Fruit.

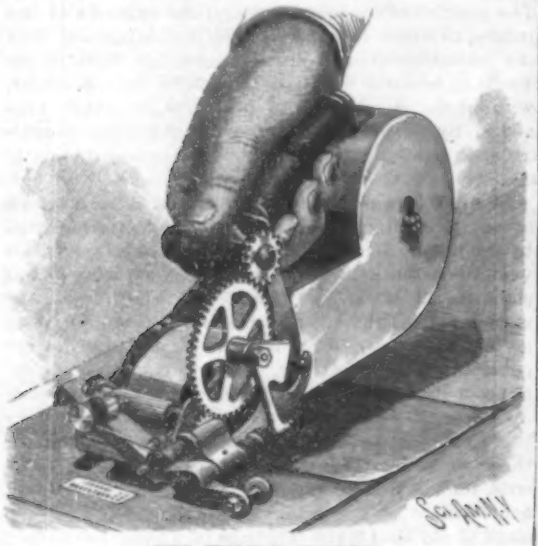
The skins of fruit should never be eaten, not because they are not palatable or digestible or are unhealthy in themselves, but on account of the danger arising from microbes which have penetrated into the covering of the fruit. Everybody has noticed that at times a slight scratch will create a considerable sore on the human body. It is generally ascribed to an unhealthy condition of the blood, but a close microscopical examination will show that it is due to the presence of microbes thus introduced into the system. So with an apple, a peach, a pear, or a grape. The fruit may be perfectly sound and healthy, but on the skin or covering may be microbes, which, introduced into the human system, will breed disease. These germs are not uncommon, neither are they always present. It is possible to eat this covering without injury, but the danger is such that it is best not to incur the risk.—*St. Louis Post-Dispatch.*

A New Southern Comet.

Mr. Gale, of Sydney, discovered a comet in R. A. 37° 42', Decl. 55° 35' S., on April 3. This was the second comet of this year, and will therefore be known as comet *b*.

AN IMPROVED MAILING MACHINE.

With most newspaper publishers it is now the practice, in mailing papers, to paste upon the wrapper a small printed label giving the name and address of the subscriber, generally accompanied by the date, in small characters, at which the subscription expires. The entire subscription list of the paper is in this manner put in type, which is kept standing on "galleys" in a miniature printing office, where changes and additions may be conveniently made on the receipt of each payment from an old subscriber,



THE HORTON MAILER.

the change of an address, or the enrollment of new subscribers, the system thus constituting also an ideal method of book keeping. From proof sheets taken previous to each mailing day, the narrow columns of addresses are pasted together to form a continuous roll or web, to be placed in a hand-operated machine, such as shown in the accompanying illustration, which automatically pastes and cuts off each single address slip, pressing it down in place upon the wrapper, by simply raising and lowering the machine. Our subscribers have for many years been familiar with this form of printed address. The improved mailer represented in the engraving has been patented by Mr. James A. Horton, of Greenfield, Mass. We have given it a thorough trial, and it works well. Although principally made of sheet metal, it is exceptionally light. The address roll is held upon a removable shaft in the large circular end of the casing, and in advance of it is a removable rectangular paste holder or receptacle, on the upper edges of which are guide clips by which the paper ribbon or web is guided over a distributing roller whose lower side dips in the paste, there being in front of the holder two paper-feeding rollers actuated by gear wheels by means of a thumb roller at the forward end of the handle piece. The feed is positive, and the slip is perfectly guided and thoroughly pasted, the machine being held naturally and easily in either hand. On the bottom plate is a knife holder block in which is held a cutter blade, a novel mechanism supporting and giving a swinging movement to a similar upper cutting blade adjustably clamped upon the knife bar, the knives having two cutting surfaces which can be easily sharpened. A rocking plate is adapted by its gravity and the force of a spring to swing downward below the bottom plate, elevating the knife bar as the machine is lifted by the operator, while the downward pressure of the plate on the wrapper of a newspaper causes the knife bar and cutter blade to swing downwardly, severing the label slip with a shearing action. By means of adjustable springs the tension of the knives can be regulated as they become dulled. The machine is well adapted for easy and rapid operation, and excellent provision is made for the ready adjustment of its working parts to maintain them in good operative condition.

An Eagle Shot while Carrying Off a Lamb.

A big crowd of villagers recently viewed the movements of an enormous bird that hovered over a field in the vicinity of Landisville, Lancaster County, Pa. A flock of sheep were grazing in the field. From a height of several hundred feet the bird would swiftly descend to near the earth, and after circling in long sweeps again mount on high.

John Musselman, one of the crowd, went for his gun. Then he watched for a chance to shoot. Suddenly the big bird darted downward, seized a good sized lamb in its talons, and began to fly off with it, the lamb meanwhile uttering plaintive bleats.

Musselman fired when the feathered robber was two hundred feet away. The bird fell dead. It was an enormous bald eagle, measuring 7 feet 2 inches from tip to tip. The lamb, still in its clutch, was also dead when found.

Cotton Bleaching.

This operation by the usual method labors under the disadvantage that the natural hue of the fiber is refractory to chlorine. Hertel has patented a process which gets over the difficulty by using Turkey red oil. A solution of this is used of from ¼ to 10 per cent strength, according to the work in hand, and in this the cotton is soaked and, after wringing, heated under pressure in a 1½ to 2 per cent solution of caustic soda for about six hours. The cotton is then rinsed, slightly acidulated, washed in a weak soap bath, again rinsed, and finally dried. It will then be a pure white. If the fiber is nearly white to begin with, the operation may be simplified by putting the oil with the lye in the digester. The bleached cotton is of unimpaired strength, free from oxycellulose and lime salts, and is, therefore, eminently suitable for alizarine dyeing.

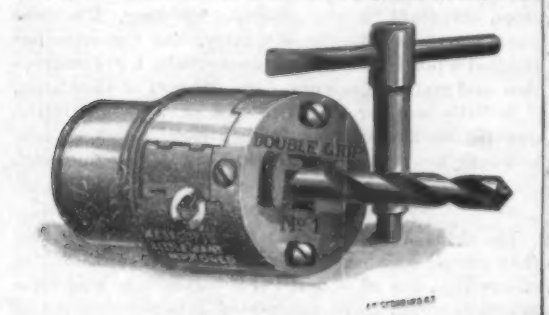
Taxing Commercial Travelers Unlawful.

An ordinance of the city of Titusville, Pa., required travelers soliciting orders to pay a license, which an agent for a Chicago firm dealing in pictures and picture frames failed to do. For this he was sentenced to pay a fine by a local court, whose judgment was affirmed by the Supreme Court of the State. The decision of the latter court has just been reversed by the Supreme Court of the United States in the case of Brennan *vs.* The City of Titusville, in which it holds, reaffirming the position taken by it in previous cases, that no State can levy a tax on interstate commerce in any form, whether by way of duties laid on the transportation of the subjects of that commerce, or on the receipts derived from that transportation, or on the occupation or business of carrying it on.—*Bradstreet's.*

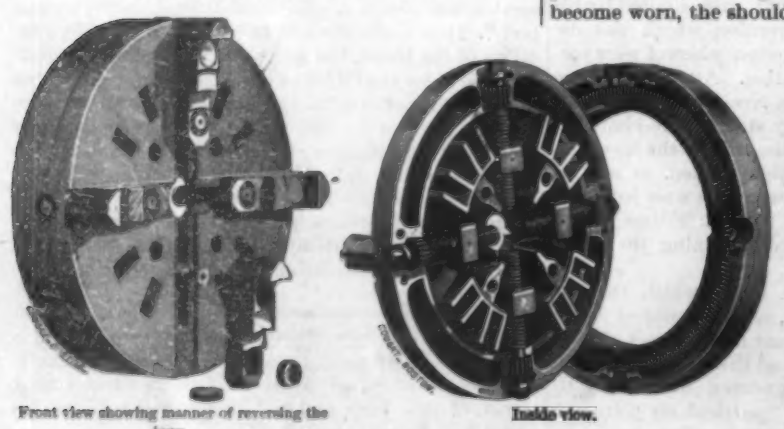
THE WESTCOTT CHUCKS.

The Westcott Chuck Company, of Oneida, N. Y., make three styles of drill chucks and six styles of lathe chucks, each of them in several different sizes, and they are all well known and standard goods, having a high reputation for their accuracy and excellence of workmanship. Their patent scroll and their geared combination lathe chucks give all the movements obtainable in both the independent and universal chucks, and at less cost than for both. The jaws are of steel, carefully hardened and ground, and are reversible, giving them the maximum of durability. The gears, pinions, screws and keys are all made of tough steel of the best quality. Each jaw of the geared combination lathe chuck shown in the illustration is attached by means of a stud and nut, the stud being a portion of the sliding box. Should the chuck body become worn, the shoulder of the stud can be faced off, thus making the jaw fit gibs closely again. The collars and pinions are not pinned or splined on the screw, but made solid with it, and the gear and pinions are in a tight shell, which prevents dirt from getting into them.

The new "Little Giant" drill chuck shown in the illustration, with "double grip," is made only by this company. It has a drop-forged steel tie plate, or extra stay, applied to the back of the jaws independent of their other adjustment, that renders it an impossibility to spread or spring the chuck body. The plate has lateral motion across the face of the chuck body, doing away with the liability of throwing drills or work out of true. This chuck is designed to be the most powerful chuck made for use on bolt-cutting machines and on screw machines, for holding iron to be threaded with a die, or wherever extra strength is needed. This chuck may be used in the ordinary way without the tie plate, and is made with diagonal or with straight jaws. The jaws of all the chucks made by the company are sold only in sets, and all parts are interchangeable.



"DOUBLE GRIP" DRILL CHUCK.



Front view showing manner of reversing the jaws. Inside view.

GEARED COMBINATION LATHE CHUCK.

AN AUTOMATIC WORD COUNTER FOR TYPEWRITING MACHINES.

This is a very simple, durable, and perfectly reliable attachment, to be applied to any common typewriter without changing the machine, where it will automatically count and register the number of words written, as each word is indicated by the movement of the space key. The improvement has been patented by Mr. A. V. Gearhart, of Wausau, Wis. The illustration represents its application to a Remington machine, the small figure being a cross-sectional view within the casing of the counter, behind the indicator disks. These disks are in series, as common to registering and counting machines, the disk at the right indicating units, the next tens, and the next hundreds, so that the three are adapted to count up to 999, and the series may be extended, if desired, to count and register any required higher number. The disks are all moved from the units shaft, to which a rotary motion is imparted by the movement of a slide worked up and down by an adjustable connection with the space key of the machine. The counting mechanism may readily be thrown out of gear when desired, and for connecting the counter with the caligraph an arrangement is provided for making the connection by an arm on an oscillating shaft. In connection with the "hundreds" wheel is a lever carrying a hammer, and actuated to strike a gong as each one hundred words is registered. When the capacity of the machine is reached, the counting disks are returned to 0, or the normal position, by simply pressing upon a button or knob in the front of the case. This counter can be made at small expense, and, in addition to its other uses, is designed to be particularly valuable on typewriting machines operated to print words coming on a telegraph receiver, where the operator writes out the words from sound and cannot so easily keep the count.

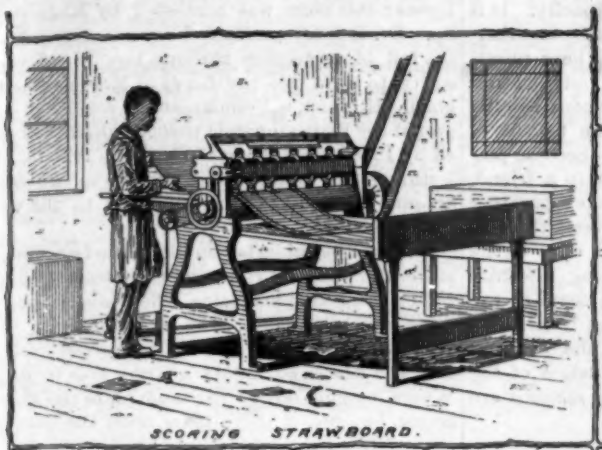
GEARHART'S COUNTER FOR TYPEWRITERS.

Drunken Sparrows.

The English sparrows have proved a nuisance in the cotton country, for as soon as the bolls open they pick out the cotton and carry it off, and some planters have lost, as they claim, hundreds of pounds in this way. There is one man, however, in DeWitt County, says the *Galveston News*, that has not lost much. When he found the sparrows were committing depredations he procured a quantity of wheat, soaked it in sweetened whisky and strewed it along the rows. The sparrows found it and thought they had a picnic. So they had. But in fifteen or twenty minutes there was the tipsiest lot of English sparrows ever seen on the face of the earth. They rolled about the ground, falling on their sides and backs and kicking their heels into the air like a parcel of drunkards, all the while uttering the most comical squeaks. They did not have long to squeak, however, for the boys gathered them up and threw them into bags. The first day they gathered two bushels of drunken sparrows. Three or four days later the experiment was repeated with almost equal success, and from time to time since. They made excellent potpie, but the survivors have come to regard the plantation as hoodooed, for now very few come about it.

PAPER BOX MAKING.

Within a few years a number of paper box machines have been invented that will turn out over ten times the number of boxes that were made on the old hand machines. The new machines run by steam power, and are used in a great many large establishments. Among the number of the machines are the scorers, rotary cutters, corner cutters, ending machines, and pasting and covering machines. The strawboard of which the boxes are made, passing from one machine to the other, is manufactured into a box in a few moments. The first operation in the manufacture of these boxes is the scoring of the strawboard. This is done by passing the sheets of strawboard between a number of scorers or cutters and an 8 inch iron cylinder, the scorers being fastened above to a dovetailed projection on the top and bottom of a movable iron bar.

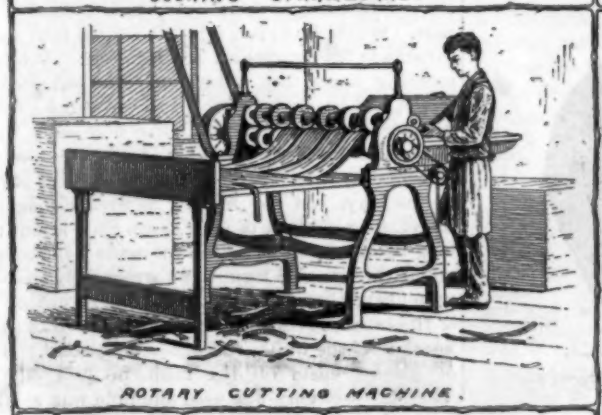


SCORING STRAWBOARD.

The cutters are about 2 inches in diameter and made of steel and are set on top of the bar (the cutter wheels coming right to a steel scale cut to one-sixteenth of an inch) to the dimensions of the box, then by a reverse lever the cutters are turned down to the cylinder. A back gauge, moved by a carrier under the table of the machine and worked by the foot of the operator, carries the board to the cutters, which score the material about half way through. The cylinder makes about 100 revolutions per minute. From 10,000 to 50,000 boards can be scored daily. The boards after scoring pass to the gluing table. The operator places two or three dozen of the scored sheets one upon another, so that the edge of each sheet projects out about ¼ inch. A coating of stiff flour paste is then brushed over the lapped edges. The attendant then doubles up the board lengthwise where it is scored and presses the two edges together. The paste causes the two edges to stick. After all are pasted a heavy weight is placed upon them and they are allowed to dry, which takes about half an hour. From the gluing table they pass to the rotary cutter, which cuts the boards into the different sizes. This machine has two steel shafts about 3 inches in diameter geared together. On these shafts are a number of cast iron rotary cutters, faced with Jessop steel, which can be shifted back and forth by loosening a screw. The lower knives are set first and then the upper ones moved close up to the others. This machine will cut three thicknesses of glued sheets at a time, cutting off from 10 to 14 boxes at a cut. It is fed in the same manner as the scoring machine, the knives making about 100 revolutions per minute, cutting about 50,000 boxes per day.

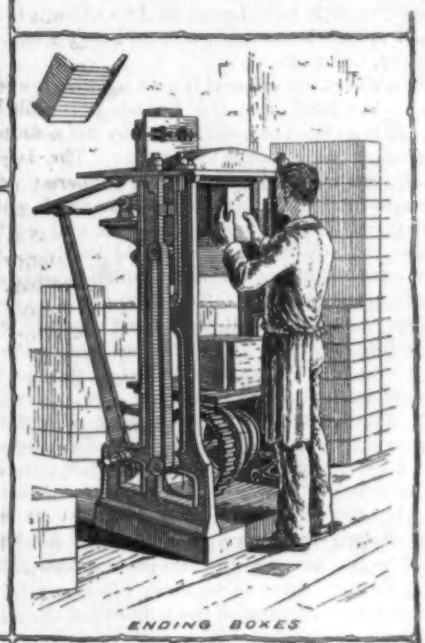
The corner cutter has a steel shaft and connecting rod and hardened stop motion. The balance wheel runs continuously, so that at any time the cutter is ready for instant use. By pressing a foot lever, the knife head makes one cut and stops on the upper part of stroke, giving the operator time to put in the work and remove it. When the work is very small, the foot is kept on the lever and the head runs continuously. The knives are made of steel, the blades of which are 5 inches in length and about 2½ inches in width. The machine can make about 55 cuts per minute, the operator cutting out about 8 corners at a time. A good hand can cut out about 20,000 per day. The ends of a large number of boxes are pasted on to the sides by what is called an ending machine. About 200 pieces or ends are put into a hopper at the top of the machine, on what is called the platen, underneath which is a slide or carrier connecting to a feeding lever which also connects itself with a gearing wheel, pulley and friction clutch to a foot treadle below. When the treadle is pressed down, the bottom end in the hopper falls down on to the carrier, which is carried forward over the top of a form, at the same time a number of spots of paste are applied to the bottom from a reservoir by a number of circular pins. The attendant holds the scored sides of the box over the form in front, the ends of which project over the top of the form about ¾ of an inch. As soon as the pasted end comes into position the form and end of box is pressed up against the platen, which is protected from breaking by means of springs, the pressure of which fastens the ends securely to the sides. A good hand can end about 2,000 boxes daily. Boxes that are covered with fine grades of paper are generally covered by machinery. A strip of paper the width of box is placed on a roller at the back of the machine. A few inches above in a glue reservoir is an 8 inch roller. The strip is passed over this glue-covered roller and under and over a few small ones to the form over which the box is placed. The operator smooths the paper down with one hand and turns the forms with the other. As soon as the box is covered a cut-off worked by the foot of the attendant cuts the strip off. The box is then taken off and another put on to the form to go over the same operation. The boxes are generally covered by girls. About 3,000 boxes can be covered daily by an expert operator. The gumming and pasting machine is an apparatus which glues or gums strips of paper or labels and at the same time carries them on a traveling belt to the operatives to be pasted on to boxes. The glue reservoir rests up against an 8 inch revolving brass roller or cylinder, the flow of which is regulated by screws at the ends. The belt is about 40 feet in length and about 20 inches in width, and made of canvas. It is connected to the machine underneath the brass cylinder. The labels first pass under the roller, the bottom of which is covered with glue which adheres to the strips. They are taken off the roller by means of a number of brass pins which cause labels to drop on to the belt which carries them off to the operatives. The machine glues from 10,000 to 40,000 labels per day. The supply of glue lasts from 10 to 30 minutes, and is then refilled. The sketches were taken from the plant of James Leo Company, Jersey City, N. J., who employ about 250 hands, turning out about 50 000 boxes per day.

JOINING



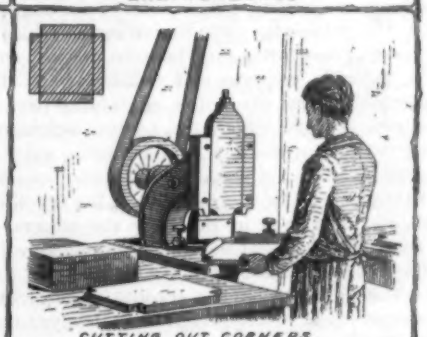
ROTARY CUTTING MACHINE.

COVERING BOXES.

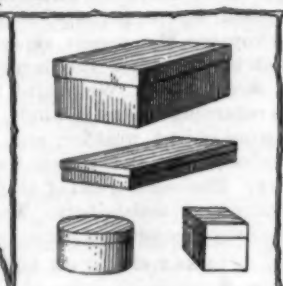


ENDING BOXES

PASTING MACHINE.



CUTTING OUT CORNERS.



CUTTING OUT ROUND BOXES.

SCIENTIFIC AMERICAN N.Y.

THE PAPER BOX INDUSTRY.

EYE TREATMENT OF EPILEPSY.—Scarcely any discovery of modern medical science is more valuable than that treatment of the eye may lead to the cure of epilepsy. In the *New York Medical Journal* (January and February, 1894) Dr. Ambrose L. Ranney, of New York, gives full details of the treatment of the eye, which he has used with twenty-five patients. The correction of the eye muscles has led to the cessation of the epileptic seizures. Most of these patients had been drugged with bromides for years without any cure. Some of the cases treated were of long standing.

One patient had suffered for twenty-four years from epilepsy; seven years have now passed since his eyes were treated, and he has had no return. Another patient had such violent paroxysms that he had to be confined in a padded room while they lasted; he is now cured; a third has been in perfect health and a partner in a large business for three years.

The Cryolite of Greenland.*

BY FRANCIS H. KNAUFF.

The earliest mention of the existence of cryolite that I have been able to obtain is in a mineralogical dictionary published in France in 1800, which says that all the cryolite then known was obtained in small lumps on the coast of Greenland. It appears, however, to have been afterward forgotten. In 1850, during an exhibition of Eskimo tools and products, held in Copenhagen under the auspices of the Danish government, Dr. Gustave A. Hartman noticed a white mineral of which the sinkers for their fish nets were made. He analyzed it, and reported it to be cryolite. The Danish government, in the following year, made investigations and discovered a large bed of the mineral on the west coast of Greenland, in latitude 61° 13'. The bed is equally distant from the small colonies of Julianshaff and Fredrickhaff, at Ivigtuk (often erroneously called Ivigtut), on the Arksuk Fiord. This bay is accessible to vessels only during the early and later parts of the summer, at other times it is full of either pack ice or bergs.

The shores of the fiord are very mountainous, and vessels in harbor there make fast to the rocky walls by their bow, while at their stern they can get no soundings. Such was the place where, in 1865, Dr. Julius Thomsen opened a mine of cryolite. Nowhere else in the world can it be obtained so cheaply, and in large quantities, for it is only found in two other places, Miask, in the Ural Mountains, and on Pike's Peak, El Paso County, Colorado.

The place where the mineral is now worked is about 12 miles up the fiord from the Danish settlement of Arksuk. It is an open cut, 600 ft. long by 200 wide, and may be worked from April to October. The way in which they protect the mine in winter is interesting.

If the mine were left unprotected, the water which runs into it would freeze, as it appeared, and solidify in layers, so that by spring there would be thousands of tons of solid ice, filling the mine, which would take a whole summer to dislodge. To prevent this, on stopping operations in the fall, they flood the pit with water, which freezes on top to about four feet in depth. Then, in the spring, a hole is punched in the ice, the water pumped out, and the remaining ice is easily disposed of. The mineral is found in solid veins in the granite mountains, penetrating upward at an angle of forty-five degrees on one side and down beneath the sea on the other. It occurs in two veins, a central portion, about 500 × 1,000 ft. in section, and a peripheral bed, surrounding the other, and merging into the granite. The line between the two veins is very sharply defined, though there is in some places an intermediate portion, consisting of the minerals of the outer zone, inclosed in cryolite. The outer vein contains nearly all the minerals, including quartz, feldspar, ivigtite, fluorite, cassiterite, molybdenite, arsenopyrite, columbite, siderite, galenite and chalcopyrite. The central portion consists of cryolite, containing pachnolite, ralstonite, quartz, sphalerite, pyrite, wolframite, arksutite (a variety of chiolite), thomsenolite, gearksutite and hagemannite. Crystallized cryolite occurs in cavities in the mass. In this inner vein, the cryolite is very pure, and increases in purity as the miners descend. At a depth of 100 feet from the surface, whole cargoes have been obtained sampling 99½ per cent pure cryolite. The impurities in the cryolite, which reduce its commercial value, are the siderite, chalcopyrite and galenite. The fluorides, such as pachnolite, are entirely unacted upon by the processes to which the cryolite is subjected.

The entire output of the Ivigtuk mines is sold to the Pennsylvania Salt Manufacturing Co., by the Danish government, while the lead and iron ores are sold to an English firm. The siderite is perfectly adapted to use in the recarburizing part of the Bessemer process of making steel.

The name of cryolite comes from two Greek words, *kryos*, ice, and *lithos*, a stone, because when the Eskimos discovered it they said they found a new kind of ice which did not melt in the summer.

In their works at Natrona, Pa., near Pittsburg, the Pennsylvania Salt Co. make the cryolite into carbonate of soda and alum, both of a purity not easily obtained by other processes. The manufacture of metallic aluminum from cryolite has been tried and proved efficient, but is not carried on to any extent at the present time.

About the time that the contract for the supply of cryolite was concluded by the Pennsylvania Salt Co., a party who was in possession of some small fragments made a series of experiments, to test its usefulness in the manufacture of transparent glass. The experiments were unsuccessful, but resulted in the production of a beautiful specimen of opaque glass, resembling French porcelain, and at a cost far below that of any existing process. The recipe consists of the mixing together of powdered cryolite and sand, in the proportion of 1 part cryolite to 2 of sand, with half an equivalent of zinc oxide. The zinc oxide need not be at all pure, and makes the glass readily fusible, as lead oxide does in the flint glass.

The resulting ware is very hard and tough, so that a vessel of the size of a tea plate, stamped out of this material with the rapidity with which such articles are made, may be thrown down violently without fear of breaking. The advantages of this material over porcelain are easily seen. Porcelain must go through the tedious and expensive processes of mixing and tempering selected clay, moulding on the wheel, drying, baking and annealing, and when finished breaks at sight.

On the other hand, a tea cup, as delicate and beautiful in appearance as china, yet strong as metal, may be made from cryolite as cheaply and rapidly as an ordinary glass tumbler.

A PUZZLE PURSE.

The purse shown in the picture is of kid, strongly sewed, its four semicircular sections constituting a common central pocket of considerable capacity. It is also easily opened when one "knows how," but otherwise this is a matter over which one may long puzzle in vain, for the parts are apparently so put together as to afford no access to the inside without cutting the leather or ripping the seams. For the benefit of the curious, or those who may wish to become possessed of a "secret" with which to entertain a friend, we will explain. Of the four central seams separating the sections, one seam is formed of transverse threads, the ends of which are in the semicircular edge of the section on either side, so that by crimping inwardly the outer edges of these two sections the seam at the bottom may be separated, allowing access to the interior by inserting the fingers between the crossing threads, these threads again drawing the edges of the seam together when the outer edges of the sections are

THE "MAGIC" PURSE.

returned to normal position. This puzzle is put on the market by the Wood Novelty Concern, No. 46 Cortlandt Street, New York City.

The Year's Steaming of the Campania and Lucania.

The Cunard steamer Campania has now completed a year's service, having started on her maiden voyage from Liverpool on April 22, and it will interest our readers to have official returns as to the performances during that period. By the kindness of the Cunard Company we are enabled to give accurate details in the two accompanying tables, one of which gives all the round voyages to date of the Campania and the other of the Lucania. These tables scarce require any comment, except, perhaps, to point out that on several voyages the vessels experienced heavy weather, which is reflected in the duration of the voyages and the mean speed. We might have quoted from the logs regarding contrary winds, head seas, and a continuance of bad weather, and demonstrated that on some occasions the vessels were in this respect unlucky. The mean speed of all the passages, however, is really most satisfactory. The mean speed for the round voyages out and home has been as follows:

MEAN SPEED ON ROUND VOYAGES.

	Campania. Knots.	Lucania. Knots.
1	20·00	20·235
2	20·275	20·86
3	21·01	19·42
4	20·495	20·71
5	19·855	19·855
6	20·16	21·285
7	21·00	....
8	20·215	....
9	19·70	....
Mean	20·301	20·304

It will, therefore, be seen that the mean speed for the nine voyages of over 50,000 nautical miles has been 20·304 knots, while the Lucania in her six voyages of over 33,500 miles has averaged 20·394 knots. The mean of all the outward voyages of the Campania was 19·83 knots, and on the homeward voyages 20·779 knots. In the first run, which affects the mean considerably, caution was desirable, owing to the fact that the engines had not been for long under steam. In the case of the Lucania the mean of the six outward runs is 20·202 knots, and of the homeward runs 20·586 knots. It may be added that three years ago we gave detailed returns of performances by competitive liners, and that the highest mean over six or seven voyages was about 19·1 knots, so that on this comparison the Campania and Lucania are 1¼ nautical miles per hour ahead of any of the other vessels, including the Majestic, Teutonic, New York and Paris.—*Engineering.*

Interesting Bullet Experiments.

Dr. Victor Horsley, F.R.S., in a recent lecture at the Royal Institution said that he intended to consider what a cylindrical bullet with a conical end does in its flight, and what it does when it strikes an animal, so that one portion of his lecture would deal with physics and the other portion with pathology. Sometimes the wounds made were such that in some Continental wars or outbreaks the one side had charged the other with using explosive bullets. Melsens, a Belgian physicist, suggested the effect to be due to the compressed air in front of the bullet, and was supported by Laroque, of Lyons; this point was contested by Magnus, of Berlin. Dr. Horsley performed several experiments with the fall of projectiles through liquids differing in viscosity, to show that the theory of Melsens does not hold good. Huguier, a Frenchman of science in 1848, suggested the hydrodynamic theory, which was established by Professor Kocher, of Berlin, in 1874-76. He—the lecturer—had found that it was due to two causes, the amount of fluidity of the solid and to the velocity of the bullet.

The lecturer projected on the screen two photographic lantern pictures representing the effects produced by a bullet from the magazine rifle when it perforates a plate of iron a quarter of an inch thick.

In the first case, the bullet telescopes itself when it hits the plate; so makes a larger hole in its passage. Where it comes out of the same plate the hole is still larger, because it there tears open the iron, which at that surface has nothing but the air behind it for support. When, however, a bullet is fired into a wet, soft substance the conditions are different. When experimenting upon this latter point, he adopted a plan which had been previously in use, of firing a bullet into damp clay, and then filling the hole made by it with plaster of Paris, to obtain a cast of the result, which he found to vary largely with the amount of moisture in the clay. At the lecture he fired a magazine rifle bullet into a block of very damp clay, about two feet long by one foot square, and it made a bulbous hole of about the size and form of an irregularly shaped Florence flask; then with a large knife he cut off the end of the block, revealing the hole, larger than a clenched hand, as if the bullet there had exploded. By means of plaster casts on the table he pointed out that when less wet clay was used the hole was smaller, and more of the shape of a soda water bottle, and with less water in the clay, still the hole was narrower, more nearly approaching an irregular tube in shape, but largest in the diameter near the further end. Sometimes there is a diversion of the bullet inside the clay from its original track, so that the casts are curved, which indicates the reason why surgeons, when probing, are sometimes unable to find the bullet. The greater the velocity of the bullet, the more destructive is it to the soft substance into which it enters. The "spin" of the bullet has little effect on the result. He concluded from these results that the magazine rifle is not a "humane weapon."

The speculation that some of the destructive effects of the bullet are due to the conversion of some of its energy into heat he did not consider to be of much moment; the heat produced is not sufficient to char particles of wool and hair carried in by the bullet. Microbes carried in by a bullet after passing through cloth can afterward be cultivated on gelatine, showing that they have not sustained a temperature above 40° C.

He next projected on the screen a picture that represented the effect of firing a magazine rifle bullet through each of two tin canisters, filled with an equal weight of lint; the relative size of the bullet is also shown. In the one canister the lint was dry, in the other it was thoroughly wet. In the first case the bullet simply perforated the arrangement; in the other the canister was hopelessly damaged, and much of the lint driven out in a kind of column at the top.

He then fired a bullet through dough containing 25 per cent water, and but moderate explosive-like effect was produced. On next firing a bullet through flour containing twice as much water, the dough was scattered in all directions.

He then showed the distribution of the energy produced by the bullet in passing through water, by means of a trough arrangement with glass sides, closed at one end with a plate of iron and at the other with good India rubber, such as "heals" itself after the passage of a bullet. This trough contained an aqueous solution of a colored dye, up to a marked level. A sheet of white paper was suspended so that its lower edge just dipped into the dye. The point at which the bullet perforated the India rubber was three centimeters below the surface of the liquid.

The result was shown by the staining of the paper by the splashing up of the colored water, and shows that the distribution of the energy is about the same as when the bullet is fired into very wet clay.

* Read before the Students' Mineralogical Club, Philadelphia, July 7, 1893.

THE LAWRENCE UNDERGROUND CONDUIT ELECTRIC TROLLEY RAILROAD.

(*Continued from first page.*)

fiber pieces, so as to insulate the different lengths. Each rail is carried by levers which run out at right angles thereto. On the outer end of the levers are weights which overbalance the girder, no springs being employed. The other end of each lever is connected to a circuit breaker which connects by vertical connection with a feed wire in the junction box. When the weights raise the trolley rail, as they normally do, the circuit is open and the trolley rail receives no current.

When the car is above any given section it depresses the trolley rail a little, forcing up the other end of the lever and closing the circuit so as to bring the depressed section of the trolley rail into electrical contact with the feed wire. As the car passes from the section of rail, the rail is raised by the weights on the lever and the circuit is broken by gravity.

The car carries a special trolley device 2 feet 6 inches long, with a wheel at each end, which is a radical feature of the system inasmuch as it prevents sparking. Between the trolley and the car is an elliptical spring, so that the shoe is always forced downward. It is the pressure of this spring that directly depresses the section of trolley rail. Another object of the two rollers is to enable the car to force down the rail in advance, before it leaves the rail it is just passing over; this prevents jarring as the rail junctions are passed. From the trolley the current is taken by ordinary connections to the motor, passes through the same, and then returns to dynamo house through the rails, or can be returned by wire, the system being admirably adapted to the use of the latter. Whether a single or double line of track be laid there is required only the one feed wire, and only the one set of circuit breakers with one or with two sets of levers. This feature is brought out very clearly in our illustration of the double track system.

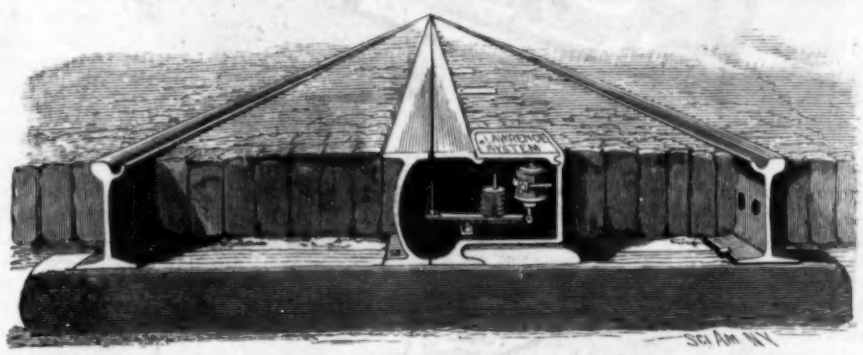
Another important feature remains to be spoken of It is assumed that the conduit will naturally accumulate dirt. To dispose of such, a brush pressing against the bottom of the conduit may be attached to the trolley shoe which will sweep all dirt before it. Every 1,000 feet or so a special pit and dirt chute, shown in one of the cuts, is provided, down which the dirt accumulated in front of the brush falls, thus keeping the conduit clean.

The experiment of running the car through water is the subject of another of the cuts, which is no fancy sketch, but is the exact representation of an actual experiment conducted on the working track now erected in the yard of the Harlan & Hollingsworth Company, at Wilmington, Del. On this occasion the ground had been so deeply submerged by the breaking down of a dike, that the car had to be reached by a boat, yet on boarding it the electrician started without the least trouble. Heretofore there have been endless difficulties with underground electrical car traction conduits, the presence of dampness, the drifting in of snow, mud, dirt, and water, have all operated to short circuit any exposed conductor placed therein, and to occasion very heavy leakage, complete disaster to the system, or to prove its impracticability. In the Lawrence system the leakage is exceedingly slight, and will not equal that in the overhead trolley system.

The original cheapness of installation is also in its favor. The very small size of the conduit necessary will permit of its being built in steel entirely above the ties, and of the 9 inches of depth, only 5¼ inches are used. When no car is on the line, the dynamos simply keep the perfectly insulated cable charged. There is absolutely no draught on them for current, as the leakage is virtually zero; if a single car is sent over the line, the system is only subject to the trifling leakage which may be incurred by the depression of a single section of the trolley rail all the time and of two sections for a very small fraction of the period. It is actually proposed, as a matter of cleanliness, to periodically flush out the conduits with water, a process which, in the case of the ordinary underground electric systems, would involve a certainty of disaster. It is not easy to see how any accident can happen to the system. If one of the circuit breakers or junction boxes, as they are called, gets out of order, the utmost harm it can do is either to keep a 32 foot section alive—involving, perhaps, a trifling leakage—or to throw the section totally out of circuit, a matter also of the least possible importance, as the car, by its inertia, would readily pass the place. A junction box can be replaced in five minutes. If any accident should happen to one or more sections of the trolley rail, the system would be still in a condition to be used, and would not have to lie idle.

The ground at Wilmington in which the conduit is laid is made ground, saturated with water and subject to continual overflow. The place is of a nature to give the road the severest possible test.

At the office of the Lawrence Electric Company, 59 Wall Street, New York, N. Y., the company which controls this invention, further interesting details may be obtained.



STEEL GIRDER CONSTRUCTION OF LAWRENCE ELECTRIC RAILROAD.

Windmill Electric Plant.

The employment of windmills for the charging of electric storage batteries has heretofore been illustrated in the SCIENTIFIC AMERICAN. The installation of this class of devices is now being done in England by the Rollason Wind Motor Company. The motor consists of a set of five curved vanes fixed to a vertical shaft. These vanes measure 7 feet by 30 feet, the longer length being placed vertically. A shield is arranged so as to allow the wind to strike only such vanes as present their concave sides to it, a vane being fixed to move the shield automatically into the proper position. The horizontal diameter of the mill is 20 feet, and it is fixed on top of an iron frame 30 feet high. The weight of all the working parts, as well as the side thrust due to wind pressure, is taken up on friction rollers running in oil baths. Owing to the reduction of friction thus effected the mill will start in very light breezes, and in one of eight miles per hour is rated at two horse power. At Willesden the motor drives a five horse power dynamo, to which it is connected by belt gearing. The dynamo is used to charge accumulators, and the latter supply a current which may be used for lighting or power purposes. The details of the electric plant have been worked out by Messrs. Edmundsons, of London. A magnetic cut-out is supplied, which breaks the circuit when the speed of the motor, and consequently the voltage of the dynamo, falls too low. An automatic switchboard has been devised, which, as the speed of the dynamo rises, alters the arrangement of the cells from parallel to series, and thus avoids the risk of buckling the plates. To cut out the dynamo when the batteries are fully charged, advantage is taken of the change in the specific gravity of the electrolyte of a cell. An hydrometer is placed in one of the cells, and as it rises, the stalk closes a light contact which brings a magnetic belt shifter into play, and thus stops the dynamo. A similar device is made use of to bring back the belt when current has been taken from the batteries.

Artificial Coloring of Fruits.

The *Bulletin d'Arboriculture*, of Belgium, points out the following sophistications to which fruits are at present submitted in Europe.

Acetate and sulphate of copper have for a long time been employed for coloring plums that are too green. The color of lemons is "improved" with citronine and naphthol yellow, and the green spots are imitated by means of diamond green.

A pleasing color is given to strawberries by sprinkling them with sulpho-fuchsine or rhodamine, or else a mixture of rhodamine and azo-red is used.

Nothing is easier than to give peaches a beautiful color. To this effect there is employed a mixture of rhodamine, azo-red and citronine, which is applied by means of a brush and a perforated plate of zinc.

The melon itself is not spared. Atropeodine or azo-orange is introduced into the interior by means of a tube, and care is taken to add a little essence of melon.

Apples and pears come in their turn, and pretty varieties of them are obtained by means of aniline colors, which attack the flesh as well as the epidermis.

At a recent dinner Dr. Villon offered his guests some pears whose exterior seemed to be intact, but which internally exhibited the colors of the French flag. The blue was obtained with Victoria blue and the red with a mixture of rhodamine and azo-red.

REMARKABLE CANNON VELOCITIES.—At the arsenal of Rochfort a 6·3 inch gun was made up to the extraordinary length of 52·5 feet by screwing additional tubes to the muzzle so as to make it up to 90 calibers in length. With a projectile of 99·2 pounds weight the unprecedented muzzle velocity of 3,983 foot seconds was obtained.

Sugar to Produce Muscular Work.

The subject of sugar as a food producing muscular power was discussed last winter before an English society by Dr. Vaughan Harley. From a brief summary of his paper, given in *Nature*, we make the following extracts:

During a twenty-four hours' fast, on one day, water alone was drunk; on another, 500 grammes of sugar was taken in an equal quantity of water. It was thus found that the sugar not only prolonged the time before fatigue occurred, but caused an increase of 61 to 76 per cent in the muscular work done.

In the next place, the effect of sugar added to the meals was investigated.

The muscle energy producing effect of sugar was found to be so great that 200 grammes added to a small meal increased the total amount of work done from 6 to 39 per cent.

Sugar (250 grammes, about 8 ounces) was now added to a large mixed meal, when it was found not only to increase the amount of work done from 9 to 16 per cent, but increased the resistance against fatigue.

As a concluding experiment, 250 grammes of sugar was added to the meals of a full diet day; causing the work done during the period of eight hours to be increased 22 to 36 per cent.

The Theory of Hail.

O. Marangoni, writing in the *Transactions of the Royal Lincean Academy* and in the *Nuovo Cimento*, has discussed the genesis, the structure, and the morphology of hail a phenomenon in which electricity plays an important part.

After criticising the theory of Volta, he expounds his own views. A hail cloud is drawn out by the wind in the form of a horizontal tongue. By its rapid evaporation there is produced an intense cold. Thus there are formed flecks of dry snow which, by friction against the minute drops of water, become, according to Faraday, charged with negative electricity, and are then attracted by the positive electricity of the drops of water. The snow flakes behind the cloud, *i. e.*, to the windward, are covered with a layer of ice, at first dry and then moistened. At the same time, according to recent researches of Lenard, which have appeared in Wiedemann's *Annalen* (vol. xlvi., 1892), they are charged with positive electricity, and are driven in an outward direction by the positive electricity of the rain drops. Thus being cooled below zero and breaking through the cloudy stratum, they become charged anew with negative electricity, are coated with a new snowy layer and are again attracted by the cloud. Each hailstone, taking a wavy line, becomes enlarged by coating itself with alternate layers of opaque and transparent matter, and is ultimately thrown to the right or the left, occasioning thus the roaring noise which precedes the fall of hail, which then takes place in two parallel bands, separated from each other by a region of rain. These views agree well with the structure of hailstones as often observed, and with narrow linear extension of the hail over belts of country, and with the generally short duration of the storm.

As regards the structure of the hailstones, the author notices the existences of a gradual passage from snow to hail. He does not, however, seem to consider the fact that hail often accompanies a westerly or southwesterly wind (equatorial current), while snow rarely, if ever, occurs except along with a northerly or easterly wind (polar current).

Some of the forms of hail studied fall without lightning, but with a strong negative potential, while the others are accompanied, in proportion to their size, with lightning and thunder.

It may be permissible to regret that the awkward word "lightning" has now become definitely established in our language in place of the good old terms "levin" and "laite."

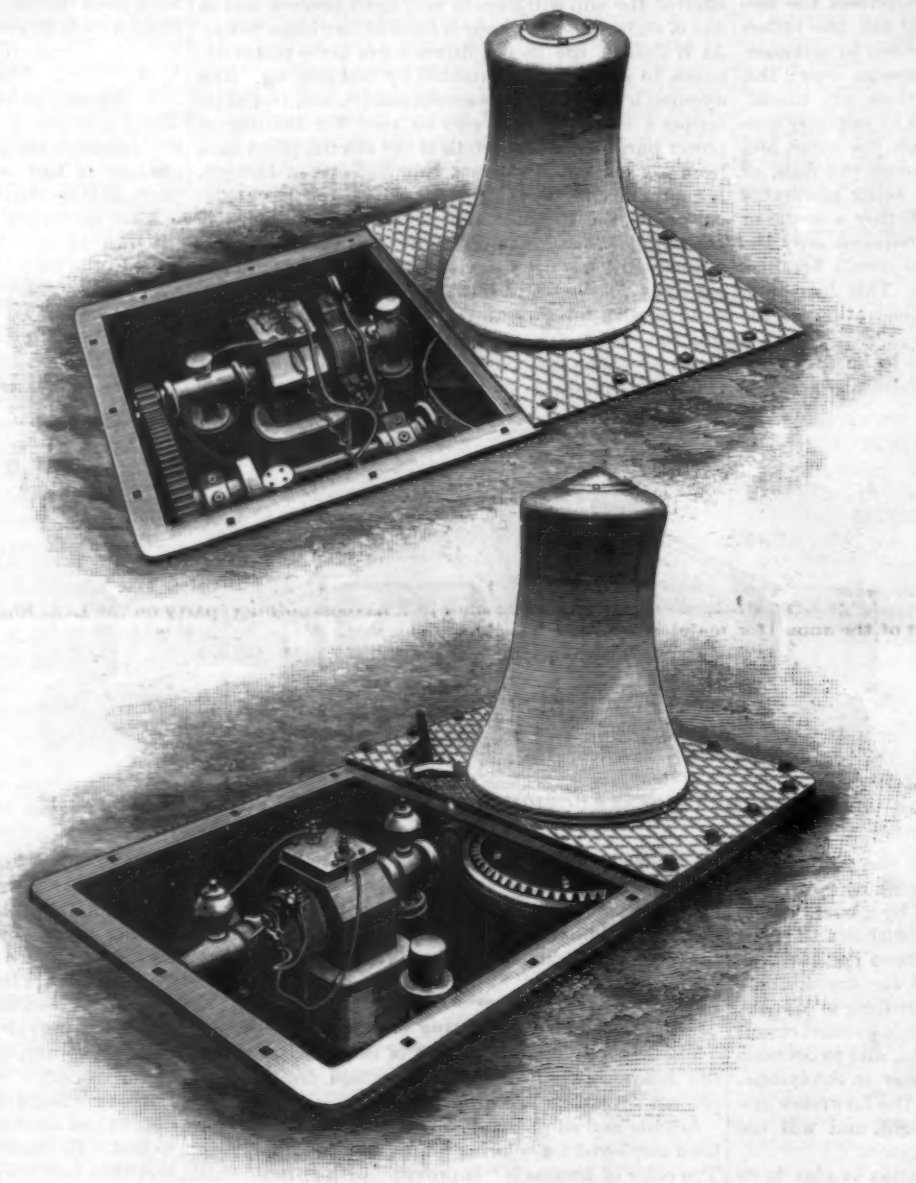
Fire in a Historic Building.

The roof of the old Speedwell Iron Works, at Morristown, N. J., caught fire April 19, and the firemen had much difficulty in saving the building. The structure has a history. It was erected just at the close of the revolution by Judge Steven Vail. On the second floor of the building Prof. Samuel F. B. Morse and young Alfred Vail worked for years to perfect the electro-magnetic telegraph instrument. On the same floor, in 1836, the first successful tests were made, and the nails used to support the wires are still sticking in the beams and joists. In the same building the machinery for the steamship Savannah, the first to cross the Atlantic, was built, and the wheels of the first American-built locomotive were made there. The bell in the belfry was cast before the revolution. It was cracked in the fire and will be recast.

ELECTRIC CAPSTANS.

The illustrations, for which we are indebted to *Engineering*, represent two electric capstans constructed by Messrs. Humpidge & Snoxell, Limited, Dudbridge, Stroud, Gloucestershire, and differing in the type of gearing adopted. Both are in daily requisition, moving coal trucks, etc., empty and loaded, to and from various parts of the yards, and each is capable of hauling two loaded 10-ton wagons round the ordinary curves and gradients at a speed of about 2½ miles an hour. The working parts are contained in a water-tight iron casing below the ground level, access to the motors being readily obtained by means of a small cover provided for that purpose. The motors were made by Messrs Crompton & Co., of Chelmsford. They are compound wound and take, in regular work, a current of 45 amperes at 110 volts pressure; but will pass a good deal more current at starting for a short time without injury. The leads are brought to the capstans in a 2-inch wrought iron pipe laid underground; and the starting switch is arranged so that the current is applied gradually, so as to start the motor without undue shock. In the one case the motor drives the hauling head by means of ordinary machine cut spur gearing, with a compressed rawhide pinion on the motor spindle. In the other capstan this arrangement was modified, and the motor is geared direct into the capstan head spindle by means of a worm and wheel. The greatest care was taken to make this latter arrangement as effective as possible; the worm was made of hard tool steel, double threaded, and provided with a proper collared thrust bearing. The worm wheel was made of phosphor bronze, accurately shaped to the worm, and the whole arrangement worked in an oil bath. The efficiency, although high, was found to be slightly lower than in the case of the capstan with the spur gearing.

The first capstan has been in daily use since May 25, 1891, and is probably the first electric capstan ever started in regular work. It has advantages over a capstan worked by water pressure, principally on the score of economy of working. The current taken is directly in proportion to the work which is being done, whereas with an hydraulic capstan the full amount of water is passed, whether any work is being done or not.



IMPROVED ELECTRIC CAPSTANS.

The Municipal Art Society.

The exhibition of the sketches in the competition invited by the Municipal Art Society, for the decoration of the court room of Oyer and Terminer in the new Criminal Courts building of New York, has recently been held in the Vanderbilt gallery of the Fine Arts Society. Forty-seven sets of designs were submitted, which showed the decorators of the American school of art to good advantage. Mr. E. E. Simmons' design carried off the first prize of $500, and he will eventually complete the work in the court room, when the finances of the society admit of paying the $4,500 additional. The society is in a flourishing condition and numbers between 700 and 800 members. Mr. Wm. A. Coffin, 1rst vice-president of the society, recently assisted a committee of citizens in Cincinnati to form a Municipal Art Society in that city, so that the good work begun in New York is already stimulating other cities to have similar societies of their own.

It is a curious and instructive fact that some of the grandest works of art ever made were produced under the direction of a committee of citizens which acted as a jury to judge of the merits of the works submitted to competition. Probably the most interesting competition on record was that for the bronze doors of the Baptistery in Florence, won by Lorenzo Ghiberti, and the dome of the cathedral of Florence, won by Filippo Brunelleschi. Both of these works are of pre-eminent importance, and the story of the competition will live forever in the delightful pages of that prince of biographers Giorgio Vasari.

IN some places boys are employed to test eggs by candle light. They earn $3 a week, and in about three months they go to the hospital suffering with sore eyes.

An Important Rubber Concession.

The authorities of Madagascar have just granted to the Hon. John L. Waller, ex-U. S. consul for Madagascar, a concession, measuring in area 15 miles square, in the district of Fort Dauphin, on the southeast coast, and which is conceded to be one of the richest rubber districts on the island. The country also abounds in ebony, mahogany, rosewood, and teak. The discovery of rubber in Madagascar is of recent date, as we noted in our issue of October 28, 1893. The *Madagascar News* states that Mr. Waller will stop the destruction of the rubber trees and vines by the natives, as far as his own concession is concerned, and will preserve them by having the milk extracted in a scientific manner. The trade will be specially benefited by the quantity of rubber which will be obtained from the new source.

Selling for Cash and Buying on Credit.

One of the anomalies of railway management is that pertaining to its financial conduct. The ordinary stock and bond transactions and the dividends and interest pertaining thereto are not here referred to, but the income and outlays attaching to the conduct of the business of the road. In ordinary commercial pursuits, and especially houses of large means, the rule is to buy for cash and sell for credit, but in railroad operation this is entirely reversed; they sell for cash and buy on credit. The charges for the transportation of passengers are collected in advance and for freight are collected on delivery, but the payments for purchases are in a majority of cases deferred as long as possible. This practically amounts to a discount of earnings and yet it is, as already stated, an almost universal practice. The fact is that railroads, as at present conducted, are run upon borrowed capital. Some of it is borrowed on its bonds; some from those of whom it purchases supplies; and some from its patrons in various ways which need not here be mentioned. Its owners (if a property so covered up with debt as to consume in its carrying charges all its earnings may be said to have owners others than its creditors) rarely, if ever, supply the capital needed to conduct the business—another particular in which railway operation differs from ordinary commercial affairs. Possibly when the stockholders of a road shall supply the money needed to operate upon a business basis this may not be the case, but until then it may be expected that railroads will go on selling for cash and buying on credit—doing business on other people's money—to their loss.—*Railway Review.*

Golden Sands of the Pacific Coast.

BY CLARENCE M. BUEL, B.M., ST. PAUL, MINN.

These auriferous deposits, denominated "black sands," occur at intervals from Takutat Bay, some 250 miles north of Sitka, in Alaska, to Santa Cruz Bay, California, and have been worked for many years with primitive appliances—sluice box and pan—the gold being fine flake or flour, less than twenty-five per cent being saved. These deposits, already mined, milled and on the dump, ready to work, contain a sufficient quantity of gold to more than pay the national debt, *could it be saved;* but the prospector, finding two hundred colors in his pan, little thinks that the color visible to the naked eye is but the 1,000,000th part of a grain, finds it so alluring that he at once rigs up a rough sluice box, and often sends a sample to an assayer who gives him returns from $5 to $40 per ton, wonders that he seldom makes more than $4 per day, though other methods have been pursued in attempting to separate the gold from the sands too numerous to relate.

Accompanying the gold is found platinum and nearly all the platinoid metals. Chlorination has been tried without success, and the cyanide process (McArthur-Forrest patent) proved a failure, the reason chiefly being that the magnetic iron, of which these deposits are largely composed, converts the cyanide of potassium into a ferrocyanide, and the zinc used in precipitation is rendered inert by reason of its speedy oxidation in the humid saline atmosphere to which it must needs be subjected. On the Oregon coast, at the mouth of the Coquille, the camp of a thousand miners a few years since is now reduced to a single miner. There are old beaches miles back from the present beaches, with beds several feet in thickness, rich in gold, inexhaustible in extent, unworked now and awaiting some method by which the precious metal may be extracted. This state of affairs exists at Gold Beach, Port Orford, Yaquina Bay, Peterson's Point, and over one hundred other localities. Yet each year sees its quota of Chinese working in their crude manner and paying a royalty of $1 per foot for the privilege.

The magnetic iron forms nearly $\frac{4}{100}$, and is a mixture of the protoxide and sesquioxide of iron, having 72 parts metallic iron to 28 of oxygen. It is quite hard and scratches glass; strongly magnetic, it is the same as the loadstone, excepting that the latter possesses polarity. It is found in nature disseminated through granite, gneiss, mica, slate, syenite, hornblende slate, chlorite slate, and limestone, and is suitable for making the finest quality of steel. Zircon is also found, though too small to be noticed except mineralogically. —*Science.*

How "Cream-colored" Milk is Made.

A writer in the *Economic Review* reveals some of the secrets of the milk trade, as discovered by himself in an attempt to run a London dairy upon honest principles. His first discovery was that all London milk had to be "dyed" to suit the London fancy. This is effected by mixing about one teaspoonful of liquid annatto, a vegetable dye of a harmless nature, with every eight quarts of milk. In vain he explained to his London customers that the proper color of most milk is white. "They insisted that my white milk was 'chalk and water,' and other people's 'cream-colored' milk was creamy, beautiful, rich, and fresh. My milk was skimmed, etc. I gave way in this thing alone. I gave them their heart's desire—the cream-colored milk."

Artificial Whalebone.

Mr. Munck, according to the *Genie Civil*, has invented a process for making artificial whalebone. He treats leather by sulphide of sodium, then soaks it for 24 or 36 hours in a weak solution of sulphate of potassium, and afterward stretches it on a frame. The skin is then dried slowly, and exposed to a temperature of 50° to 60° C. The influence of light, combined with the action of the sulphate of potassium, renders the gelatine insoluble in water. The skin is then submitted to pressure, and its properties are thus very nearly those of real whalebone as regards hardness and elasticity.

AN IMPROVED CULTIVATOR.

Our engraving represents an ingenious machine constructed by Messrs. Galland & Granjon. It is an improved cultivator that can be easily operated by one man. It appear to us as if it ought to be added to the most interesting of agricultural implements. It is assuredly destined to render services in substituting perfect mechanical work for labor that is laborious when done by hand. If we are to believe the documents communicated to us by the manufacturers, the operator, having to exert a stress of but from nine to ten pounds upon the winch handles, can produce, through the combination of the gear wheels, a stress of from 440 to 450 pounds upon the toothed cylinder, designed to dig up and turn over the earth.

The principle of the invention consists in the use, for the digging and weeding of the ground, of a cylinder armed with steel teeth, to which is communicated a rotary motion for the purpose of causing the curved teeth to penetrate the earth. Upon operating the machine, the earth caught between the teeth is lifted and turned over in a continuous manner. The machine, while operating, causes the carriage that supports it to move forward. The frame of this carriage is provided with a series of knives that pass between the teeth and cut and break the clods of earth at the moment that they are lifted.

Our figure gives so correct an idea of the device that it will not be necessary for us to give a long description of it. It will be seen that the apparatus consists of a central frame, carried by another frame on four wheels. The shaft, which is provided with large teeth or picks, constitutes the digging cylinder. A chain passing over the shaft engages at the top of the upright frame with a sprocket wheel that receives its motion from the winch handles. In order to regulate the tension of the chain, the sprocket wheel and gear wheels are mounted in a cap terminating at the upper part of the frame. The apparatus, as we have said, is supported by four wheels, two in front and two behind. The wheels are mounted at the extremity of levers jointed upon the axis of the digging tool. A special combination formed of connecting rods permits, through the winch handles, of raising or lowering the tool at will. This maneuver serves on the one hand to regulate the depth of the digging, and, on another, to entirely lift the tool above the ground in order to permit of the moving about of the apparatus.

There is a slightly smaller size of the mechanical digger than the one shown in our engraving. It is provided with two wheels only, but works in nearly the same manner as the first model. This cultivator may be advantageously employed for gardening and for the culture of all plants that are grown in rows, such as grapevines, beets, hops, tobacco, etc. The depth of the digging may be regulated at will. One man, with this machine, can perform the same work as five or six laborers using the mattock; besides, the work is much better done, since the earth is turned upside down and the clods are divided into small fragments through being cut by the steel knives mounted between each row of teeth.

The style herewith figured is capable of digging to a depth of from six to seven inches for a width of twenty-six inches. The smallest model digs to a depth of from four and one-half to five inches for a width of from eighteen to twenty inches. The weight of the machine renders it easy to handle. The large size weighs 308 pounds and the small one from 22 to 132 pounds. Let us add that the operator, while the machine is in action, preserves a vertical position, which is much more hygienic than is that of the present method of working.—*La Nature.*

AN IMPROVED CULTIVATOR.

Long Distance Transmission of Steam.

At a recent meeting of the American Society of Mechanical Engineers, Eckley B. Coxe described a method he had used in carrying steam a long distance. At a colliery they wished to carry steam to a water works about 4,500 feet over a hill from the boiler plant. A trough was made by nailing the edges of two boards together, so that they formed a right angle. The trough was supported by two stakes driven in the ground and crossing just beneath the trough. The pipe was laid in the trough resting on cast iron plates, the pipe surrounded by mineral wool and a similar inverted trough placed over the top. To allow expansions, a bend was made to one side at the top of the hill, and then it was turned back to its original direction. A large receiver was introduced in the pipe at the pumps. This was made of three sheets of an old boiler, and was 34 inches in diameter. This also served as a separator. As the elevation was 1,800 feet above the sea, the cold was excessive in the winter time, but this arrangement has been in use since 1877, has cost nothing for maintenance, and has given no trouble. Mr. Coxe believed that the secret in carrying steam long distances to an engine without causing a drop in the steam pressure was in the use of a receiver or reservoir.

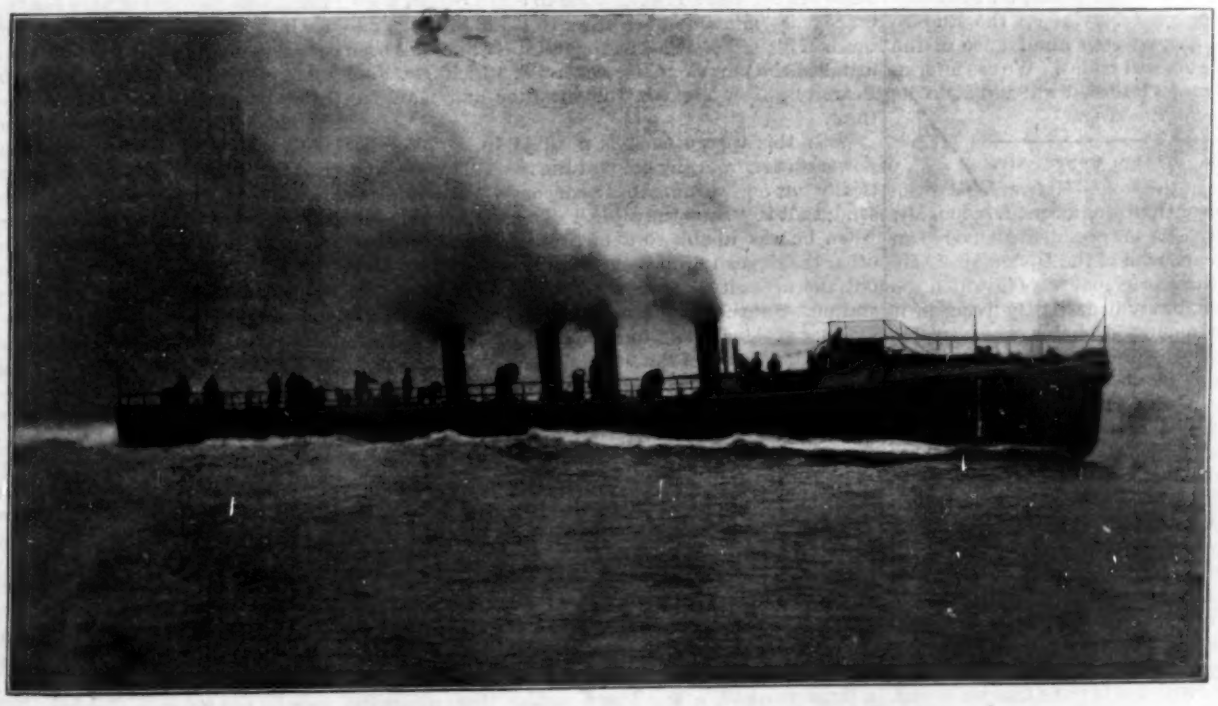
THE TORPEDO BOAT DESTROYER HORNET.

We have in previous numbers given particulars of the two new sister torpedo boats Havock and Hornet, lately added to the British navy. Both are remarkable for speed. The Hornet has attained 28 33 knots or 32½ miles per hour, which is a little in excess of the speed of the new torpedo boat built in Germany for the Brazilian government, of which an illustration is given in our this week's SUPPLEMENT.

The Hornet is 180 feet long and 18 feet 6 inches wide, and is of the usual torpedo boat construction in general appearance. The Hornet has eight boilers. The hull is divided into thirteen compartments by watertight bulkheads, 76 feet amidships being devoted to machinery space, and 30 feet abaft this to the wardroom and cabin, where the officers are berthed, while the crew is accommodated forward, the space under the turtle-back affording a commodious forepeak. The full complement is forty-two, officers and crew. These boats differ from the torpedo boats proper in having at the ends watertight flats, which give the security of a double bottom. The bunker capacity is sixty tons, which gives a radius of action, on fuel carried, of 4,000 miles at ten knots; so that the vessels may be considered "ocean-going" in the widest sense, as they would never be likely to be required to go out of steaming distance of a British coaling port in time of war. The armament consists of one 12-pounder and two 6-pounder guns, one pair of swivel torpedo tubes on deck, and a built-in torpedo tube in the bow. These dischargers are for 18 inch torpedoes. On her trial the mean draught of the hull of the Hornet was 5 feet, but if the propeller be included, the draught would be 7 feet 6 inches, as the blades project below the bottom. The displacement would be about 220 tons at this draught.

The torpedo boat destroyers are all twin-screw, and the engines in the Hornet are of the ordinary tri-compound torpedo boat type, designed by Messrs. Yarrow. The cylinders are 18 inches, 26 inches, and 39½ inches in diameter, the stroke being 18 inches. There is a separate cylindrical condenser to each engine. The usual air-compressing, distilling, electric light, and other auxiliary machinery is carried. There are a 24 foot whale boat and two 20 foot Berthon boats. The safety valves on the boilers are arranged to lift at a pressure of 180 lb. to the square inch.

The boilers are the most interesting feature in this boat. The heating surface in each boiler is 1,027 square feet, and the bar surface 20·6 square feet, the bars being 6 feet 6 inches long. The weight of each boiler with water and all fittings is 5 tons 7 hundredweight, and it has been found on test that a single one of the Hornet's boilers will evaporate 12,500 pounds of water per hour. The boilers are arranged in two groups of four, and are placed in two separate stokeholds.



THE BRITISH TORPEDO BOAT DESTROYER HORNET.

Seventy Miles an Hour.

The special train bearing the Vanderbilt inspection party on the Lake Shore recently made some fast time between Cleveland and Buffalo. The run from Cleveland to Erie, a distance of 95½ miles, was made in 95 minutes, including a four minute stop at Ashtabula for water, making the total running time for the 95 miles 91 minutes. From Collinwood yards an 88 mile run was made in 82 minutes, including another four minute stop. From Collinwood to Saybrook, a distance of 42 miles, was made in 36 minutes, or at a rate of 70 miles hour. The run from Kingsville to Dock Junction, 33 miles, was made in 28 minutes, or a rate of 70·7 miles an hour, the fastest time ever made on this division of the road. The locomotive pulling the train was No. 188, one of the Brooks Locomotive Works 10-wheel passenger engines. This run would seem to disprove the statement made by some railway experts that only an 8-wheel type of locomotive was adapted for high speed.

Lehigh Valley engine 655, lately rebuilt, was tried between Buffalo and Batavia, N. Y., on May 7, and ran a mile in the face of a strong wind at the rate of 82½ miles per hour. It is expected this engine will be able to average 70 miles an hour drawing a heavy passenger train.

SANTA FE, N. M., was founded in 1605, and is 7,000 feet above the sea.

CHLORINE water decomposes so readily that if found at all in the stores it is generally of poor quality. Sealed glass tubes containing five grammes of liquid chlorine are now to be had in commerce. With one of these it is possible to extemporaneously prepare one kilo. of chlorine water.

The High-Speed Brake Trials.

The trials of the Westinghouse high-speed brake on the Pennsylvania Railroad, April 10 and 11, were a disappointment, the wheels being slid by the great pressure, and the stops being longer than those made with the ordinary quick-acting brake. The rails were in bad condition, however, and this undoubtedly contributed to the result.

The trials were conducted by officials of the Pennsylvania Railroad in the presence of representatives of the brake company and various railroad companies. The place selected was on the Philadelphia division, and the plan was to run two trains on parallel tracks at the same speed and apply the brakes at the same moment. One train was fitted with the high-speed brake, having a foundation brake which gave a leverage of 180 per cent with an emergency application and the regular air pressure. The pressure in the cylinder was decreased approximately with the speed by a pressure release valve, until the brake power was reduced to the regular amount, viz., 90 per cent of the weight on the wheels. The other train was fitted with the regular quick-acting brake, giving a brake power of 90 per cent of the weight. The result of three simultaneous runs was that in each case the high-speed brake slid the wheels and did not stop in as short a distance as the ordinary quick-acting brake; at forty-four miles per hour the stops were 712 feet and 800 respectively; at fifty-seven and one-half miles they were 1,593 feet and 1,636 feet; at fifty-nine miles, 1,323 feet and 1,454 feet. The track was a down grade of about 27 feet per mile.

After these trials two runs were made with the train fitted with the quick-acting brake, using also the pressure release valve and employing 100 pounds air pressure. The pressures rose to 80 pounds in the cylinder and at fifty-seven and one-half miles the stop was made in 1,155 feet and at sixty-two miles in 1,325 feet. By comparing this with the record of the same trains using ordinary pressures and without the pressure release valve, it will be seen that much better stops were made.

It may be argued that the condition of the rails was against the high-speed brakes, but probably a powerful brake is never required more than when a high-speed train is trying to make its schedule time in bad weather. At first sight the conclusion seems inevitable that with this brake too great a leverage has been employed. But we have heard no one speculate upon the results if the stops had been made at seventy-five or eighty miles per hour. We doubt if the wheels would have slid. And those are the speeds at which we understood this brake was to have been most serviceable. Certainly we are waking up to the requirements of the case at a very late date, if we must have a new form of brake for stops at forty-five, fifty or fifty-five miles per hour.

But granting that the brake would have met expectations at really high speed, is it not going to be a source of danger and expense if improperly applied at speeds under forty-five miles per hour? The one hundred pound pressure quick-acting brake, on the other hand, has already done good service on the Empire State Express, and is a great step in advance of the present practice for high-speed trains. We are informed that the Pennsylvania Railroad will use it on its fast trains.—*Railway Engineering.*

Phenomena of the Upper Air.

At a recent meeting of the Royal Meteorological Society at the Institution of Civil Engineers, London, Mr. Richard Inwards, F.R.A.S., the president, delivered an address on "Some Phenomena of the Upper Air." He said that there are three principal ways in which the higher atmosphere may be studied: (1) By living in it on some of the great mountain chains which pierce many miles into the air in various parts of the globe; (2) by ascending into it by means of balloons; and (3) by the study of the upper currents as shown to our sight by the movements of the clouds.

After describing the effects of rarefied air on animal life and natural phenomena, Mr. Inwards proceeded to give an account of various balloon ascents which had been undertaken with the object of making meteorological observations.

In 1850 Messrs. Barral and Bixio, when they had ascended to 20,000 feet, found the temperature had sunk to 15° Fah., but this was in a cloud, and on emerging from this 3,000 feet higher, the temperature fell as low as minus 38°, or 70° below freezing point. In 1862 Mr. Glaisher and Mr. Coxwell made their famous ascent, when they reached an altitude of about seven miles from the earth. A short time ago a balloon, without an aeronaut, but having a set of self-recording instruments attached, was sent up in France, and from the records obtained it is shown that a height of about ten miles was attained, and that the temperature fell to minus 104° Fah.

Clouds are simply a form of water made visible by the cooling of the air, which previously held the water in the form of invisible vapor. Every cloud may be regarded as the top of an invisible warm column or current thrusting its way into a colder body of air. After referring to the various classifications and nomenclatures of clouds, of which that proposed by Luke Howard in 1803 is still in general use, Mr. Inwards said that whatever system of naming and classifying clouds be adopted, it should depend on the heights of the various clouds in the air, and he gave a few rough rules by which the comparative altitudes of the clouds may be judged when there is no time or opportunity to make exact measurements. Among the indications by which a cloud's height in the air may be gathered are its form and outline, its shade or shadow, its apparent size and movement, its perspective effect, and the length of time it remains directly illuminated after sunset. By the last method some clouds have been estimated to have been at least ten miles above the surface of the earth. The cloud velocities at high altitudes have been carefully noted at the Blue Hill Observatory, Mass., U. S. A., and show, practically, that at about five miles height the movement is three times as fast in summer and six times in winter as compared with the currents on the earth's surface.

Cable Tramway Signaling System.

In cable tramway work in America, where, as a rule, says the *Railway World*, a speed considerably greater than would be permitted in England is usual, the absence of some method of instantaneous communication with the engine room has been not infrequently the cause of serious accidents. While the gripman of a cable car has ordinarily complete control of its movements, there is just the possibility of the gripper becoming entangled with the cable in case of a partial fracture of the latter, so that the gripman may find it impossible to drop the cable. In this case the car continues its course with a speed equal to that of the cable until the accident has been notified to the power stations, and the cable has been stopped by shutting off steam from the engines. Meanwhile, the danger to pedestrians and general traffic is imminent, as the conductor is powerless to check the speed of the car. Instances of this occurred soon after the opening of the new cable line on Broadway, New York, before the gripmen had become accustomed to the management of the cable, and on one or two occasions a runaway car did serious damage before the cable could be stopped. As a consequence, the system was subjected to much unmerited abuse, which, now that the gripmen have acquired experience and accidents no longer happen, has turned to commendation. But the misfortunes of the Broadway line have resulted in the invention of an electric signaling system, embodying some novel features, which apparently precludes the possibility of any danger from a stranded cable, even in the case of the most unskilled gripman.

The system is now in working order on the Third Avenue Cable Railroad, of New York. This line extends from the Post Office to 130th Street, and is worked by two power stations; one located at Bayard Street and the other at 65th Street. From the former the cable extends south to the Post Office and north to Sixth Street, about a mile in each direction; from the latter are driven two cables—one to Sixth Street, a distance of 2¾ miles, and the other to 130th Street, a distance of 3¼ miles. Throughout all these lines has been installed the new signaling system, of which Mr. Fred Pearce, of New York, is the inventor and manufacturer.

With this apparatus it is possible to signal either power station from any point of the road. There is practically but one warning that a car conductor requires to send; that is, "Stop the cable." This would occur only when he was unable to detach the gripper; in every other case he can drop the cable and stop his car without the necessity of communicating with the power station. But the new system provides for an indefinite number of signals, and in addition secures communication with any one of the five stations.

Placed between the tracks, at regular distances from each other, are manholes, each containing a so-called "automatic," from which lead the wires of cables to the power house and telephonic stations. Plug switches are provided, where the wires of the telephone can be attached when it is necessary to talk from any manhole to any other manhole, or to any of the stations.

Each signal sent consists of a certain number of strokes on a gong, each having an arbitrary meaning. One stroke means "stop the cable;" two strokes, "go easy;" three strokes, "go ahead;" four strokes, "fire." In the engine room of each power house are two gongs, a large one and a small one, and on these gongs the signals are sounded. Two gongs are used in order to distinguish between the different portions of the road. When the larger gong rings it means that one of the 65th Street cables must be stopped instantly, and the engineer at the Bayard Street house knows that the difficulty is not with his line. At the same time an annunciator is dropped at the signal box in the 65th Street house to indicate whether the "up" or "down" cable from that house is in trouble. When the smaller gong rings the Bayard cable is stopped, and the 65th Street house ignores the signal. So far, this only provides for the stopping of either cable, and is done, presumably, by either the gripman or conductor of a car.

When the conductor raises the cover of the manhole he lifts the automatic by means of its handle. This strikes one in each power house, on either the large or small gong, according to the location of the automatic sending the signal. This is all he is expected to do, except to replace the cover, which he cannot do without first depressing the handle of the automatic. Raising the automatic to send the first signal, "winds up," so to speak, the mechanism of the automatic, so that it is prepared to send its own number automatically when the tripping occurs.

Every signal sent is printed upon a tape, and the time of its receipt is also recorded.

When a signal is received the wrecking wagon from the nearest station is sent to the automatic from which the signal was sent. This carries a telephone, by means of which conversation can be carried on with either telephone station or either power house. After the trouble has been remedied, the automatic is again brought into use to signal the engine room. The automatic is raised once for each time it is desired to strike the gong.

From the foregoing it will be seen that the cable can be quickly stopped by any employe of the company, the engineers considering the notice to stop as imperative.

The fact that the automatics are operated by the breaking of a closed circuit is a point of the greatest value. As is well known, it means that upon the breaking of the circuit at any point, and from any cause, the signal is instantly transmitted to each station. If this signal is not followed within a reasonable time by the number of an automatic, the conclusion is reached that the circuit is broken, and repair to the line is needed.

Lifting a Locomotive under Difficulties.

The *Portland Transcript* gives the following account of the raising of a Canadian Pacific mogul engine that ran off an embankment into Harvey Lake on the night of January 13. The work was carried on under great difficulties, with the thermometer often being 30° below zero, and a snow blowing over the lake at times more than 50 miles an hour, causing a suspension of the work for days at a time. In preparing to raise the locomotive, weighing 60 tons, sixteen holes, 3¼ inches diameter and 20 inches deep, were drilled in the solid rock and as many steel posts were planted and set in lead. These were for fastening guy lines and purchases, and the men who drilled and set the posts were kept from freezing by the aid of fires kindled upon the snow. A number of ingenious fastenings for purchase blocks were made very near the track by sinking heavy oak timbers in trenches at the ends of the ties that were tamped with gravel and wet, which after twenty-four hours were frozen so solid that they were quite as strong as the iron fastenings upon the bluff. Very heavy shear poles, 30 feet in length, were built and erected to overhang the embankment, and were provided with two sets of very heavy ship blocks and falls for lifting, and two of equal strength were placed in position for pulling from the bluff. As no diver was employed, everything was done from the surface, and every precaution was taken to prevent delay to trains. By the aid of a swinging mirror attached to a long pole, with light thrown upon it in the night by a dark lantern, successful fastenings were made to the engine 15 feet under water with heavy grappling hooks. The driving wheels were badly entangled in bowlders, rendering it next to impossible to move the monster. With three locomotives working upon independent purchases, and aided by the buoyancy help of the water, it was finally drawn to the surface. At one time, while attempting to raise the engine and tender, it was found that the locomotives were exerting a force of 240 tons.

How to Give a Fomentation.

Only those who have not tried the remedial effects of water, both hot and cold, doubt its efficacy in many forms of disease. It is perfectly safe to apply a fomentation in case of severe pain before a physician is summoned, and very often it relieves the sufferer before he arrives. This is the way to do it: Take half a dozen thicknesses of flannel large enough to more than cover the seat of the pain, fasten them together, for convenience in handling, wring them out of very hot water (use a clothes wringer to save the hands) and apply as hot as the patient can bear it. A dry flannel may be put between the skin and the wet cloth, if preferred, and over all a large flannel should be placed to keep the heat in. When the cloth begins to feel cold, it should be wrung again. Three or four applications will generally relieve a stiff neck or an attack of rheumatism in a joint.

A fomentation may be needed when there is no hot water in the house. It may be quickly prepared by wringing out the flannel compress in cold water, laying it between the folds of newspaper and putting it on a hot stove or holding it around a stove pipe until hot. The paper protects the cloth, and when steam begins to come out can be easily removed.

BICYCLE EXERCISES AT LEIPZIG.

"Professional Riding for the Championship of Europe for 1894." Under this title two of the most celebrated artistic riders competed in Albert Hall of the Crystal Palace at Leipzig on January 25 last. They were the American, N. C. Kaufmann, and the Frenchman, August Gouget. Kaufmann had often been in competition with Gouget, and has now won the championship. The competition was so arranged that the champion was to perform feats which were to be performed afterward by his adversary, and *vice versa*. There were two referees, who were to select a third. These three judges chose a jury consisting of five men, who were to fix the number of points to be given, the highest number of points to be given for one exercise being five. The two competitors put up a stake of 1,000 marks ($238), and besides this the victor received a gold medal worth 300 marks ($71). The contest lasted four hours, and was watched with the greatest interest by an audience of thousands. Each rider performed feats in his own way on cycles of all kinds. While the Frenchman excelled more in gymnastics and acrobatic feats than in balancing, Kaufmann surprised the audience by a number of tricks such as had never been seen before, which he performed with wonderful skill, surety and elegance. Kaufmann won by 284 4-5 points against 228 2-5 points.

In the accompanying engraving we show a number of the exercises which were performed by the two men, Figs. 1 to 6 being feats performed by Kaufmann, some of which were well copied by Gouget, and others not as well; while Figs. 7 to 10 illustrate exercises in which Gouget far surpassed his opponent. The remarkable exercises on the steps and ladder were not attempted by Kaufmann. Gouget was not to be scorned as an opponent.—*Illustrirte Zeitung.*

BICYCLE EXERCISES AT LEIPZIG.

Woman's Suffrage and Woman's Brain.

The present very active and enlightening agitation over the question of woman's suffrage calls up again the many now established facts about the physiological differences in the nervous system of the sexes. Not very long ago, Sir James Crichton Brown delivered a series of lectures in which he aimed to show, from actual data, that the brains of women were not only relatively smaller, but essentially different in structural arrangement and functional characteristics from those of men. He in particular showed that the vertebral arteries in women are larger in proportion to the carotids than they are in men, and that the cerebellum and posterior parts of the brain were therefore more nourished proportionately. The brain of woman is four per cent smaller than that of man after deducting the factors of height and weight (Debierre), and woman's brain, as soon as it reaches its apogee, immediately begins to decline in weight, so that senile atrophy is manifested sooner than in man.

There is no doubt, we believe, in the minds of physiologists that the mental characteristics of women have a structural basis in the conformation and amount of her nervous tissues, and that no amount of training will make the male and female brain alike.

Of course, all this does not in the least prove that woman's mind is not adapted to the demands of suffrage, or of political, jury, and militia duty. It only shows that the result of conferring suffrage cannot be positively predicted either one way or the other, since it would be injecting into our political system an entirely new factor.

We admire the eloquence and are affected by the enthusiasm of the agitators for and against suffrage. But we have little faith in those who assure us that it would surely be a blessing—or a curse—if women went to the polls and sat in the jury box. It is an experiment which may or may not turn out wisely.—*Med. Record.*

The Fall River Liner Priscilla.

The trial trip of the Priscilla, the new steel passenger steamer of the Fall River line, the largest side-wheel steamer afloat, took place May 9. Her speed is 20 knots an hour. The hull of the Priscilla, built by the John B. Roach Company, of Chester, Pa., is 423½ feet long on the water line, 53 feet on the beam, and 20½ feet in depth, divided into 61 water-tight compartments. The main engine has 8,500 horse power, and drives a pair of feathering paddle wheels, 35 feet in diameter. The engines and boilers are similar to those in the other Fall River boats, except that the motive power is greatly increased. The boilers—ten in number—are of the single-ended Scotch type, maximum pressure 150 pounds. The boilers have a mean diameter of 14 feet and are 14½ feet long. The steamer is provided with two large fire and wrecking pumps on the main deck. The engines and boilers were made at the works of W. & A. Fletcher, Hoboken, N. J.

The Priscilla is decorated in the style of the Italian Renaissance. The great staircase, which from time immemorable has been a distinctive feature of the American side-wheeler, is of solid mahogany. The quarter-deck is laid in marble mosaic. The dining room is finished in mahogany. Five decks permit of large rooms for the use of the passengers, the saloon being particularly fine. There are 361 staterooms, and in the cabins are 219 berths. The steamer is lighted by 1,900 incandescent lamps, and there is also a cold storage plant. The Priscilla will carry, in addition to her cabin passengers, 89 second-class passengers. The total cost of this magnificent vessel, when complete, will be $1,500,000.

The Army as a High School.

We gave prominence to Captain Burns' proposed system of army education in accordance with our general policy of encouraging discussion on subjects relating to the interest of the services. There is another side to the question, and this is presented in a communication we have just received. Our correspondent asks a question that is being asked by many other officers of the army, and that why the district school should be brought into the army; why in time of peace men who are not even possessed of a common school education should be enlisted for the army. The country has a school system, a good one, free to all who choose to avail themselves of it. A young man whose early youth has been so misspent that he is an ignoramus at the age of twenty-one should not, our correspondent thinks, be allowed to encumber the service. It is nothing to the purpose to say that his want of the knowledge that every American boy of fourteen ought to possess is his misfortune, not his fault; that the necessity of working for a living has kept him away from school. The same plea may be advanced, relatively, by the youth with a spinal curvature, that he is not to blame for the disqualification. There is no lack of young men who are fit, mentally as well as physically, for the ranks. The recruit is to be a soldier, and if, after he has enlisted, he is to pass a portion of his time in learning what every young American is supposed to know, so much time is taken from that which might be spent in teaching him how to become a soldier. When the recruit goes to the post school, he does so by order; he is thus made to feel his ignorance, and that he is in this respect apart from and beneath his fellows, and he does not like it. That is to say, the American youth does not. The foreigner who enlists for food, shelter, pay, and clothing, cares very little about anything else, for he has always been under somebody in the Fatherland.

Many of the enlisted men who make up the vast European armies are necessarily recruited from the peasantry who are dull naturally, and ignorant from force of circumstances. Such men offer a fine field to the schoolmaster. But with an army of only 25,000 men we can afford to be more circumspect and to reject applicants who have not already received the elementary instruction that Europeans find necessary to administer to their untaught masses. The American youth is usually in advance of it; and if the recruiting officers will exert themselves the new men who come into the service need not be a stupid lot. Let there be a system of instruction at all posts, but let it be military in its trend, our correspondent argues, and serve for those who show aptitude for the position of non-commissioned officer and for those who desire to go up for examination for commissions. Let the instruction be of such a nature as to create in the mind of the soldier the conviction that he is bound to make fair return to his country for its fostering care of him and of his home.—*Army and Navy Journal.*

FROM many observations and experiments M. Ph. Lenard finds that drops of water falling upon water or wet bodies generate electricity, the water becoming electrified positively, and the air escaping negatively electrified from the foot of the fall, and light impurities in the water diminish the effect considerably. The essential conditions of electrification are the concussions among the drops themselves and against the we rock, no effect being due to the water's fall through the air and its dispersion by it. A jet of water falling from an insulated tank to an insulated pail electrified the latter positively, while the negative electrification of the surrounding air grew to several hundred volts.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Charles H. Smith, Birmingham, Ala. This is an improvement in the side-latching type of coupler, and the invention provides novel, simple, and efficient means for connecting such a coupling with the elongated coupling link of an ordinary link and pin coupling, also providing an attachment for the drawhead of a side-latching car coupling which will prevent the drawhead from falling upon the track in case it becomes detached from the car frame at its rear end, together with a novel means for uncoupling a partly detached drawhead.

LUBRICATOR FOR CAR OR OTHER AXLES.—John S. Washburn, Hackensack, N. J. Although more especially designed for railroad use, this improvement is also applicable to shafts of stationary machinery in mills or elsewhere, where the shafts have end play in addition to their rotary motion. The box has a lower oil chamber or space, and carries a free-rocking oil-lifting apron operated by the end play of the axle to raise the oil lifter and convey the lubricant from the well to the journal, which will thus be positively and automatically lubricated with but little or no friction. There may also be arranged on the opposite side of the box a sponge carried by a spring to more effectually promote the distribution of oil along the axle journal.

SWITCH WORKING MECHANISM.—Robert E. Brackelsberg and George G. Edwards, Portland, Oregon. These inventors have made an improvement in devices to automatically throw a switch by the movement of a train, and which will also close the switch. The mechanism is of a simple and substantial character, and may be connected with any ordinary switch or switch stand, the connection being so made that the switch may be operated by hand in the usual way, and also operated by the train without interfering with the switch stand.

Electrical.

COMMUTATOR BRUSH.—Rudolf Kersberg, Hohenlimburg, Germany. This brush consists of a metallic cloth or fabric formed of wire spirals screwing one in the other, single wire spirals being inclosed in the fabric. The device is simple, durable, and efficient, and so arranged as to prevent the dust arising from the contact of the brush with the commutator from settling in or adhering to the parts forming the brush.

Agricultural.

PLOW.—John D. Burkhart, Charlie H. Waterman, and John D. Smith, Dayton, Washington. These inventors have made an improvement in combined hillside and sulky plows, providing a double plow carrying a right hand and left hand share, and means whereby either plow may be readily carried to and from engagement with the ground. The forward axle may also be adjusted independently of the adjustment of the plow-shares, and either beam and its share may be disconnected from the carriage, both beams being normally connected with the carriage in such manner that one plow will ride upon a swiveled wheel on the land, independent of the other plow, in position for work.

MOWER.—Richard McGahey, Walla Walla, Washington. This is an improvement in machines having the finger bar and sickle located at the front, ahead of the team, the invention providing a construction whereby the team can draw the machine with less labor than when attached to a side bar machine, the machine being more readily manipulated, and adapted to be directed straight across a field or worked along a hillside. The sickles are in view of the driver, who completely controls every part of the machine, in which there are less than the usual number of parts, so that it can be very economically and strongly made.

CHEESE-FORMING MACHINE.—Henry R. Van Eyck, Zeeland, Mich. To work soft cheese into proper form, and cut it into cakes according to a predetermined weight, is the design of this machine, in which the invention consists principally of a conveying and agitating screw operating in a casing having a contracted outlet discharging onto a conveyer belt propelled by the cheese discharged from the outlet, the speed of the belt being governed by the weight of the cheese on it.

BAND CUTTER AND FEEDER.—William S. Van Wechel and Dennes L. Wynn, Orange City, Iowa. These inventors have designed a simple and inexpensive mechanism to be connected with any ordinary threshing machine, to feed bundles of grain to the cylinder, cut their bands and separate them so that the unthreshed grain will be evenly fed. The machine is adjustable for bundles of different sizes, is designed to be thoroughly efficient, and not liable easily to get out of repair.

Miscellaneous.

MILK WAGON.—Nicholas Milbank, New York City. This wagon is especially devised for the carriage of bottled milk in the boxes in which the milk was primarily packed, thus avoiding the necessity of extra handling of the milk, which is carried in this improved wagon in a manner most convenient for removal.

HORSE COVER.—Edward H. Cooper, Fond du Lac, Wis. As an improved article of manufacture, this inventor has devised a form of blanket fastening, permitting the blanket to be drawn closely to the animal at the front, or left loose as may be desired, a novel form of girth hook aiding in such adjustment.

HORSE SHOE.—Frederick W. Bach, New York City. This shoe is provided on opposite sides with a series of calks arranged diagonally, with the outer portions ahead of the inner portions, thus spreading the effective bearing points of the several calks over a pretty large surface. The calks are not continued to the outer curve of the shoe, and are not liable to injure the horse's legs or feet, but they give the shoe a strong grip on the ground to prevent the slipping of the horse in any direction, when either pulling or backing.

ANIMAL MUZZLE.—Thomas H. Johnson, Plymouth, Fla. A frame fitting the animal's muzzle has a gravity-actuated guard piece at the nose, permitting cattle or horses on which it is applied to eat grass or herbage with their heads in lowered position, while the parts automatically adjust themselves when the head is elevated to close and lock the front of the muzzle, preventing the animals from injuring fruit trees, etc.

ANIMAL TRAP.—Frank D. Hay, Keokuk, Iowa. This trap has a dumping platform which forms a perfect support for an animal entering, but which acts to deposit the animal, after entry, into prison compartment, from which escape is impossible. The trap is especially designed to catch and cage rats and mice.

CLOTHES LINE SUPPORT.—Charles G. Norlin and Frank Lindstrom, Marquette, Kansas. The line is, according to this invention, made fast at one end, and is pendent near its other end on a rotatable pulley, there being a weight on the pendent end of the line, while there are link bars loose on the line adapted to engage hooks on the supports. The improvement affords ready means of placing clothes on the line and making the line taut without the use of props.

HAT OR BONNET HOLDER.—Isaac D. Van Gordor, Niles, Mich. This is a novel supporting device particularly adapted for the adjustable support of a trimmed hat or bonnet, either in a shipping box or on a display stand, so as to securely hold the article in a desired position, and avoid dislodgment, while it may be readily removed when desired without injury. The holder consists principally of a base to be secured to the bottom of a box, and having a socket in which is held a standard carrying two pairs of horizontally projecting and curved limbs.

MATTRESS FILLING MACHINE.—William H. Putnam, Durand, Mich. This machine has upper and lower stretches of pliable material, a follower, a take-up mechanism, and side and top and bottom boards, by means of which the filling may be readily and conveniently held in proper quantity and perfect distribution, and fed in that shape to the casing, the filling while being forced into the casing having pressure equalized upon it to such an extent that no portion of the filling will be disturbed while it is being placed in the casing. The machine is of durable and inexpensive construction, and readily adjustable to produce mattresses of different sizes.

SOFA BED.—Eric Sodergren, Brooklyn, N. Y. This inventor has designed a compact construction affording a receptable at one end of the sofa, and within the sofa frame a vertically adjustable spring bed, connected with the sofa seat so as to be elevated when the seat piece is elevated, and thus removed from the top of the sofa frame, and to be automatically depressed to a horizontal plane by a return of the seat piece. The sofa is thus readily convertible into a single bed that does not take up more floor space than the sofa.

DEVICE FOR LIBERATING ANIMALS.—Charles C. Partridge, Hyde Park, Mass. This improvement is specially designed for releasing horses from the fastenings in their stalls in case of fire, and leading them out of the stable. In connection with sliding partitions between the stalls are locking devices connected with a cable operated by a drum mechanism on the outside of the building, whereby the animals connected with the releasing cable will be forced to move therewith, and will thus be led out of the building.

MAKING STAINED GLASS PANELS.—Henry C. Hughes, London, England. This invention is an improvement on a former patented invention of the same inventor, for welding together differently colored pieces of glass in artistic design, and painted with vitrifiable enamel color, substituting in the process a cheaper and better material than sheet platinum, and providing also an improved bed upon which the welding is effected, the bed replacing the fire clay slab previously designed.

CUTTING MACHINE.—Perry E. Wilson and Philip M. Hesch, Jr., Titusville, Pa. This invention relates to machines adapted to cut paper, asbestos cloth, etc., from rolls, the machine provided being capable of handling large and heavy rolls, and having means for conveniently adjusting the rolls vertically, also cutting the material in strips of any desired length, the cutting and feeding mechanism being so arranged that they may be operated at any point on one side of the machine.

WHEEL TIRE.—Harry M. Devoe, New York City. This is an elastic tubular tire provided interiorly with a continuous coil spring whose convolutions are connected on the inner side of the tire by wires interwoven with the coils. The improvement forms a tire for pulleys and wheels for frictional driving gear and for vehicle wheels in which collapsing will be avoided and the necessity of inflating with air will be obviated, the tire not being destroyed or materially injured by being punctured.

SPOKE SOCKET.—Philipp Schneider, Chattanooga, Tenn. This is a re-enforce and protecting device, comprising two half sections each formed with a semicircular end portion, the adjacent edges of which join to completely encircle the spoke when fitted thereon, the same being securely held in the felly sockets, and preventing the dirt from entering and the spokes from becoming quickly worn or weakened.

TRUNK.—Ernst L. Forsgren, New York City. This trunk has a removable casing within an outer shell, and its construction is such that it may be conveniently packed and articles readily removed from any compartment without disturbing the contents of the other compartments. The casing is mounted to turn in the shell, and is provided with longitudinal partitions forming separate compartments, with a hinged cover for each compartment made of two spring-pressed sections.

GRAIN METER.—James W. Coker, Niles, Mich. This is a device for attachment to an ordinary grain chute to automatically measure and discharge the grain, and consists of a tilting comparted box turning on a stationary pivot below the chute, and having two notches in a circle whose plane is perpendicular to the pivot, a stationary curved apertured plate forming the bottom of the comparted box, while there is a movable wing in the chute and a latch operatively connected with the wing and adapted to engage either of the notches to lock the tilting box in either of its normal positions.

BAG HOLDER.—George S. Ingle, Evansville, Ind. This invention comprises a portable frame with uprights in which slides a platform, and means for raising, lowering, and locking it, a detachable spout or chute being vertically adjustable on the standard, and there being movable hooks attached to the spout for supporting the mouth of a bag and holding it open while being filled with grain. By means of the adjustable platform, bags, barrels, etc., may be readily raised to such height that they may be conveniently handled.

COPY HOLDER.—Rosecrans Sheldon, Chicago, Ill. This is a device of simple construction, on which a book or manuscript may be readily fastened and held at any desired angle. It also has an aligning arm adapted to move over the lines to be copied to indicate the progress of the copying, simple means being provided for moving the line arm line by line by merely touching the handle.

STAMP HOLDER AND MOISTENER.—George Loomis, Parkersburg, West Va. In the front portion of this box is a sponge cup, at the rear of which are vertical stamp compartments in which the stamps lie singly, one upon the other, on spring-pressed plates, whereby they will be normally raised to about the level of the box, from which they are removed separately and drawn over the top of the sponge.

PASTEURIZING AND RACKING OFF BEER.—Adelbert O. Müller and Andreas Giesen, Fremont, Neb. These inventors have devised a very cheap and simple apparatus through which beer to be racked or bottled may run in a constant stream, and by means of which the beer may also be sterilized and cooled to its proper temperature. The operation is such that the froth is kept back and the beer is delivered without loss of carbonic acid gas.

REGISTERING MEASURES OF LIQUIDS.—Francis Gerau, Brooklyn, N. Y. This is a device to be attached to a faucet, to indicate and register the number of glasses or measures of liquid drawn from a cask or barrel. The construction of the mechanism is such that, when connected with a faucet for drawing beer or ale, it registers only when the device is turned in one direction, enabling the glass or measure to be brought beneath the faucet as many times as necessary to properly fill it.

DESIGN FOR A BOTTLE.—Alphons Dryfoos, New York City. The cross section of this bottle is approximately triangular, but with one of the sides of the triangle convexed to form the segment of a circle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE CENTURY COOK BOOK AND FAMILY MEDICAL ADVISER. By Jennie A. Hausay. Chicago: Laird & Lee. 1894. 16mo. Pp. 353, illustrated. Paper. Price 25 cents.

This low-priced receipt book contains a large number of plain practical receipts in which all foreign names for dishes or their ingredients are eliminated. The work is profusely illustrated. The sections devoted to "Table Etiquette" and "How to Keep Persons and Things Neat and Fresh" are especially valuable. The medical section treats of emergencies and all the diseases which are so ill-advisedly treated in receipt books, such as consumption and scarlet fever.

AN INTRODUCTION TO STRUCTURAL BOTANY. (Flowering Plants.) By Dunkinfield Henry Scott. London: Adam & Charles Black. Pp. 288, 113 figures. Price $1.

This book is designed to be a first guide to the study of the structure of plants, and to awaken among pupils in schools and private students a genuine interest in the study of living things. Three types are especially made the subject matter of study, exemplified by the wall flower, the lily, and the spruce fir, with the idea of imparting as thorough a knowledge as possible of a few plants rather than scraps of information about a larger number.

SUN AND SHADE. An artistic periodical. New York Photogravure Co. Large quarto, monthly. $4 a year.

The April number of this periodical contains eight plates: Rose Coghlan, the noted actress; The Reproof; Aristocracy; A Study from Life; Salvator; The Drunkard's Wife; Smithsonian Institution; An Avenue of Willows. The very high character of the work has given this publication a well deserved reputation. Each picture is worth being framed, and will bear as close criticism as many much more expensive proof prints. The publishers announce as a special feature a series of reproductions directly from the original paintings of the gems of the British National Gallery.

WATER OR HYDRAULIC MOTORS. By Philip R. Bjorling. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1894. 308 illustrations. Pp. 267. Price $3.50.

The author has placed this book before the public to supply a want which seems to exist for a treatise on this subject which shall give a treatment not too mathematical for the general reader. In all hydraulic machinery there is an especial temptation toward mathematics, a temptation which the author seems to have succeeded in resisting. The work is very excellently printed on good paper, and has numerous illustrations.

A TREATISE ON ELEMENTARY HYDROSTATICS. By John Greaves, M.A. Cambridge. 1894. Pp. 201. Price $1.10.

The volume just reviewed was commented on as being without mathematics; the present one treats the subject of hydrostatics more generally, and with mathematics to the exclusion of calculus, except where certain alternative proofs are given using this mathematical method. It is written for an especial English examination, so that it is definitely limited in scope.

THE MAGNETO HAND TELEPHONE. Its construction, fitting up, and adaptability to everyday use. By Norman Hughes. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1894. Pp. 80. Price $1.

The title of this very neat little manual indicates its subject. It is devoted to the telephone, which is now public property. It is very short and practical, and will be found valuable for amateurs and beginners in the art. A considerable portion of the treatise is devoted to the practical lineman's work.

HOW TO RUN ENGINES AND BOILERS. Practical instruction for young engineers and steam users. By Egbert Pomeroy Watson. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1894. Pp. 125. Price $1.

Like the volume on telephones reviewed above, this belongs to the Spon & Chamberlain series of practical hand books. It is an entirely practical book, and one which we think will be of value to the engineer. At its end it contains a species of contents mistakenly termed an index.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

MAY, 1894.—(No. 103.)

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1. Elegant plate in colors showing a handsome residence recently erected for William H. Bartlett, Esq., at Evanston, Ill. Two perspective views and floor plans. Mr. J. L. Silsbee, architect, Chicago, Ill. A very picturesque design.
2. Plate in colors showing a cottage at Mt. Vernon, N. Y., recently completed for E. J. Walther, Esq. Two perspective views and floor plans. Mr. L. H. Lucas, architect, Mt. Vernon, N. Y. An excellent design.
3. Cottage at Morgan Park, Ill., recently erected for G. F. Patterson, Esq., at a cost of $3,000 complete. Two perspective views and floor plans. Mr. H. H. Waterman, architect, Chicago, Ill.
4. A summer house at Southampton, Long Island, N. Y., recently completed for H. M. Day, Esq. Two perspective views and floor plans. A model design. Messrs. G. E. Harney & W. S. Purdy, architects, New York.
5. A residence at Portchester, N. Y., recently erected for Walter S. Haviland, Esq. Two perspective views and floor plans. A very pleasing design. Mr. Louis Mertz, architect, Portchester, N. Y.
6. Floor plans, interior view, and two perspectives of a residence recently completed at Hackensack, N. J., for George A. Vroom, Esq. An excellent design and unique plan. Cost complete $6,950. Mr. Christopher Meyer, architect, New York City.
7. The Barnum Institute of Science and History, of Bridgeport, Conn., donated by the late Phineas T. Barnum. A one-half page perspective view. Cost for building and grounds $100,000. A fine example of the Romanesque style of architecture.
8. A residence at Stamford, Conn., recently erected for Oliver G. Fessenden, Esq., at a cost of $5,199. Two perspective views and floor plans. Mr. Wm. H. Day, architect, New York City. A very pleasing design.
9. A cottage of moderate cost recently completed for Hiram R. Smith, Esq., at Randall Park, Freeport, Long Island, N. Y. Cost complete $3,900. Two perspective views and floor plans. Mr. Wm. Raynor, Freeport, Long Island, N. Y., architect. A very attractive design.
10. "Otter Cottage," recently completed for Henry H. Adams, Esq., at Belle Haven Park, Greenwich, Conn. Mr. H. W. Howard, architect, Greenwich, Conn. An attractive design in the colonial style of architecture. Two perspective views and floor plans.
11. A colonial cottage at "The Bluffs," Mt. Vernon, N. Y., recently completed for E. A. Hunt, Esq. Two perspective views, an interior view and floor plans. Mr. Louis H. Lucas, architect, Mt. Vernon, N. Y.
12. Half-page engraving showing hall and staircase of a London dwelling.
13. Miscellaneous Contents: Clients' right of replicating design.—Shop and mill construction.—Seasoning oak.—Beautiful designs in parquetry work, illustrated.—The effect of fire on concrete.—Waterproof cellars.—Embossing wood.—Steel butt with ball-bearing washers, illustrated.—"The Holland" radiators, illustrated.—Graphite paint.—Sandpapering machines.—The Van Wagoner & Williams Hardware Company.—Window screens and screen doors.—Maple flooring.—The Pullman sash balance, illustrated.—Portland cement walks.—Subterranean London.—An alloy which adheres to glass.—A saw clamp and filing guide, illustrated.

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Cheapest Water Power.—See top of 1st column, page 110. Also top of 2d column, page 220. Look, it will pay.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6037) R. R. says: Will you please give a good formula for a shoe dressing for ladies shoes? A. 1. French dressing for shoes: Logwood extract, 3 ounces; dissolve in 2 quarts of water; borax, 3 ounces; dissolve in soft water, 2 quarts; and add ¾ ounce shellac, boil to dissolve; bichromate of potash, ¼ ounce; dissolve in soft water, ¼ pint; and add 3 ounces ammonia water, mix all together. 2. The following is a German recipe: Dissolve 3½ ounces of shellac in half a pint of alcohol. Rub smooth 25 grains of lampblack with 6 drachms of cod liver oil and mix. A few drops are to be applied to the leather with a sponge.

(6038) D. S. S. writes: In the diagram, query 5985, page 209, current volume SCIENTIFIC AMERICAN, I think there is an error. When the switch arm is moved to *b*, it forms two circuits, one over the line and one short circuit through the telephone. Also at the other end of the line the current would divide, part going through the bell and part through the telephone, and I think the bell would fail to ring. By arranging two cut-outs to cut out the telephones, I think it would work better. A. The high resistance of the telephones is relied upon to cause the current to pass through the bells. If the telephones have a low resistance, the plan will not work without considerable battery.

(6039) L. R. S. asks: Will you please answer the following questions in Notes and Queries: What is the cause of rust that forms on zinc etching plates? The only use that has been made of them has been to mould from for electro plates, and pull a few proofs of them on the press, and then clean off with gasoline. The plates are kept in a vault and steam heat is on all the time to keep it dry. Can this corrosion be prevented? How? And can the plates be cleaned without injury to them? A. The rust or corrosion is generally caused by moisture. In some cases galvanic action may be set up. Vaseline would probably protect the plates without injuring them, but it must be entirely removed before the plates can be used for printing. Benzine can be used for removing ink from the plates.

(6040) J. E. B. writes: The question having arisen to what depth a foundered iron vessel would sink, A claims that it will only sink a certain distance, and then remain there, suspended, as it were, while B says that it will go clear to the bottom and lie there, no matter how deep, as the pressure increases equally on all sides as it sinks. The question of currents is not to be taken into consideration. The writer would also be pleased if you could inform him how the great depths of the oceans are determined? A. Everything that sinks beneath the surface of the ocean goes to the bottom at whatever depth. Even the silt and mud carried into the ocean from the rivers finds its way to the bottom of the ocean. Although the pressure at great depths is immense, 0·43 of a pound for every foot in depth, the density of water, owing to its slight compressibility under great pressure, is but very little greater at the bottom of the deep ocean than at the surface. Fish, shell fish, and the minute life organisms of the sea live at the greatest depths. B is correct. Steel sounding lines and iron balls are used for the greatest depths. To facilitate the opertion of sounding, the ball is disengaged when it strikes the bottom and the line measured back on the reel.

(6041) J. H. asks: Would it affect the running of the simple electric motor described in "Experimental Science" if the core were not one continuous wire, but three pieces hooked together? A. It is immaterial whether the iron wire of the armature core is in one piece or not. It is not necessary to fasten the pieces together.

(6042) C. T. W. asks: At what temperature would water boil in a perfect vacuum? A. Water boils in a vacuum at 80° Fah.

(6043) E. H. S. asks: 1. How many pounds pressure must 70° air be subjected to, to have a temperature of 35° when allowed to expand? A receptacle holding 10 cubic feet of air naturally, how many cubic feet will be forced into it when it is compressed to 15 pounds per square inch? How many at 30 pounds per square inch? A. Air at a pressure of 5 pounds at 75° will drop to 35° when expanded. Practically there is a small loss in effect that requires about 8 pounds pressure for practical operation; 10 cubic feet in addition to the air already in the cylinder will produce 15 pounds gauge pressure; 20 cubic feet for 30 pounds pressure. By compression the air becomes warmer and will show the pressures named on the gauge before the above quantities are compressed. The figures are for isothermal conditions.

(6044) A. A. S. asks: Can a vessel used to measure the rainfall be bought? If so, at about what price? I am told that a good carpenter can make one. Please give me a few pointers on the subject. Never having seen one, anything concerning them will be appreciated by your subscriber. A. Rain gauges with instructions may be purchased from Queen & Co., Philadelphia, Pa., for a few dollars, or any tinsmith can make a rain gauge as follows: Make a common tin funnel such as used in every household and by liquor dealers, 6 inches in diameter at the top, and place a cylindrical rim around the top with a sharp edge at the top exactly 6 inches in diameter and 1¼ inches high. Also a rim on the outside of the cone 3 inches in diameter and 1 inch high to just slip into a tin cylinder 3 inches in diameter on the inside by 10 inches in height, with a flat bottom. Place the funnel and cylinder together and set 2 feet above the ground, fastened to prevent movement by the wind. The measurement of the depth of rainfall caught in the funnel and deposited in the cylinder will be just four times the depth of the rainfall. Use a thin slip of wood marked with inches and tenths for a measure.

(6045) W. P. A. says: We are considering the advisability of burning shavings, sawdust, and small kindling in our boiler furnaces instead of coal, as heretofore. Which is the best way of feeding this into the furnaces, by hand or automatically, and if automatically, what device is the best? A. Automatic feeders have been made for blowing sawdust and shavings into the fire under boilers. We do not advise its use, on account of its want of reliability and safety. The setting of boilers and furnaces for sawdust, bagasse, shavings and dust fuel are illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 501, 624, 625, 10 cents each mailed. We have no record of parties making the automatic feeders.

(6046) S. B. W. asks whether the atmosphere surrounding the earth is heated by convection or radiation. A. The atmosphere is heated by both radiation and convection. It not only absorbs the radiant heat of the sun as it passes to the earth, it also absorbs the heat of the warm earth surface by contact and circulation, which is the mode of convection.

(6047) J. S. says: Will you please inform me what kind of fluid I can use to write on glass? A. Diamond ink.—Diamond ink is made by mixing with hydrofluoric acid enough barium sulphate to give it consistency, so that it will not spread, and show well on the glass. Ammonium fluoride may also be added. After the writing has stood some time it is washed or dusted off, and the etching appears. Use a glass pen.

(6048) L. L. M. asks a good and inexpensive way to make a small aquarium, about 15×10×8 inches. A. A small and well proportioned aquarium might be about 20 inches long by 4 inches wide by 14 inches deep. Make the frame of stout tin; cut eight strips 14 inches long and four strips 20 inches long. They may all be about 1¾ inches wide; now angle them in pair of clamps, and you have the required number for the frame, *i. e.*, four uprights at 14 inches; a piece across top and bottom at each end, 14 inches; and four pieces, 20 inches, for top and bottom at sides; solder them firmly together, being careful to get the frame square. You had better strengthen the corners by angling some short pieces and soldering firmly over them; these will also hide the joints. These pieces may be fancifully cut, unless you intend to case the frame afterward. Having put the frame together, you should have a flange round the inside of the bottom part. Cut a piece of galvanized sheet iron, rather stout in substance, to fit. Bed it firmly in with red lead cement, red and white lead mixed like putty. Tack it here and there with solder to the frame. Before putting in the bottom, make the holes and arrangements for fountain and waste, also runaway, and whatever you require. You may now put in the glass; 28 ounces, or even 21 ounces will stand the pressure very well; but an accidental knock would be fatal. If you can use plate, it will be much better. Bed it firmly in with lead, solder tabs of tin or copper close up at top and bottom. Clear away the superfluous lead, which will squeeze out between the frame and glass neatly, and let it set hard.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 8, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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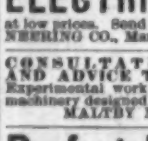
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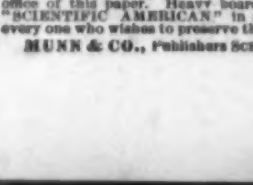
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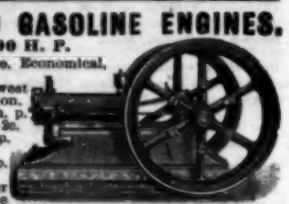
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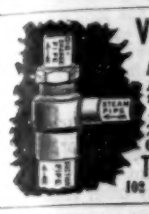

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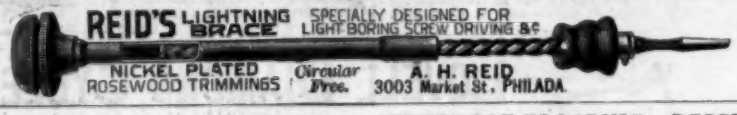

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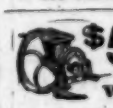

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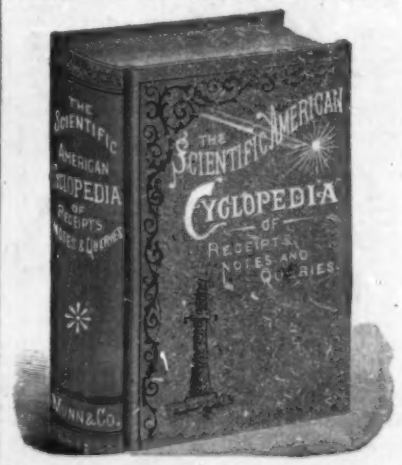

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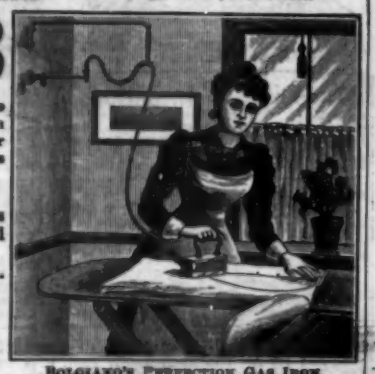

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